RAILROAD GAZETTE

FRIDAY, MARCH 8, 1895.

CONTENTS

	PAGE
ILLUSTRATIONS:	
The Weaver Rocking Grate of the Lehigh Valley Railroad	156
Sixty-thousand pound Coal and Platform Car for the C., C., C. & St. L. R. R.	147
The New Holyoke Dam	148
The Standard Box Car of the New York Central and Hudson River Railroad	148
Double Radial Drill—Niles Tool Works	151
CONTRIBUTIONS:	
The Inventor of the Walschaert Valve Gear	145
The Morgan Engineering and Fielding & Platt Suits	145
A Balanced Locomotive	145
The Nicaragua Canal Route	145
EDITORIALS:	
The Pennsylvania Railroad Report	152
Classification of Fixed Signals	152
Train Resistance as it is	153
Annual Reports	153
The Railroad Bond Market for February	154
EDITORIAL NOTES	152, 154
New Publication	155
Trade Catalogues	156
GENERAL NEWS:	
Locomotive Building	157
Car Building	157
Bridge Building	157
Meetings and Announcements	158
Personal	158
Elections and Appointments	159
Railroad Construction	159
General Railroad News	159
Traffic	160
MISCELLANEOUS:	
Technical	156
The Scrap Heap	156
Notes on Modern Practice in Signaling	145
The Rules of Interchange	146
Fast Trains on Western Roads	147
Abolition of Grade Crossings in Buffalo	147
The Hudson River Bridge Specifications	149
Train Resistance	150

Contributions.

The Inventor of the Walschaert Valve Gear.

ZÜRICH, Feb. 21, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The Belpaire-Stévart gear is perfectly known to all European locomotive engineers. It is a very clever one, and was applied to the "Centenaire" locomotive, which was exhibited in Antwerp in 1885. In the *Railroad Gazette* of Feb. 8 a correspondent makes a great mistake in attributing the invention of the Walschaert gear to Heusinger von Waldegg. Walschaert was the first inventor and Heusinger von Waldegg applied this system later without knowing the existence of the Walschaert system; but what is important in this question is the difference between Walschaert's and Heusinger's systems.

The Heusinger system has a quite different way of uniting the rod of the gearing valve with the crosshead; you will find a complete Heusinger gear applied to locomotives described in "Die Steuerungen der Locomotiven," by Prof. Albert Fliegur; Meyer & Zeller, Zürich. This gear was applied to a single locomotive by the inventor in Germany, and the invention did not prove very satisfactory.

The Walschaert gear is now the favorite gear on the Continent, where it obtains great success, especially in the application to four-cylinder compound engines.

American railroad engineers ought to study, I think, more carefully the European locomotive gears; they would not, perhaps, stick so closely to the Stephenson gear, which is nearly the only one known and applied in the United States.

C. A. BARBEY.

The Morgan Engineering and Fielding & Platt Suits.

ALLIANCE, O., Feb. 28, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In a recent issue of the *Iron Age*, under the head of "Machinery," there appeared an article concerning the settlement of suits between Fielding & Platt, of England, and the Morgan Engineering Co., wherein it was said that the Morgans agreed to forego a verdict of $10,600 and pay $4,500 besides.

It is true that we obtained such a verdict on the ground of defective machinery furnished by Fielding & Platt, but the $4,500, which was an undisputed balance of account due from us, was deducted therefrom, leaving a net verdict in our favor of $6,100. It is not true that after the argument in New York there was any prospect of the court disturbing our verdict. It was very evident that Judge Hammond, who tried the case, would support the verdict in our favor, and knowing this to be so, the representatives of Fielding & Platt proposed a settlement, which, with modifications, we accepted. In this suit, after a long trial, the jury had found as above stated.

At the same time another suit was pending by Fielding & Platt against us, wherein they claimed many thousands of dollars as royalties on what was called "Tweddell's system." The settlement was this: 1st, Fielding & Platt had paid substantially all the costs (a large sum) in both suits to date of settlement, and this they released; 2d, Fielding & Platt released us from all alleged claims for royalties, and dismissed their suits; 3d, each party paid one-half the remaining costs; being a small sum; 4th, we paid the balance of account due from us.

We should not feel at liberty to state the terms of settlement, but for the evident fact that the article in question emanated from the other side. It will at once be seen that the terms of the settlement were entirely satisfactory to us.

MORGAN ENGINEERING CO.

The Nicaragua Canal Route.

CARTAGENA, Rep. of Colombia.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Owing to the distance between us I am somewhat late in sending this comment on the letters of Prof. Courtenay De Kalb and Mr. J. F. Le Baron on the Nicaragua Canal location, in your issue of Jan. 18.

I am very glad to see that Mr. Le Baron, who was in Nicaragua in the employ of the canal company at the same time that I was myself, had eyes to see somewhat beyond the range of his transit, as directed by his chief, and that he has the courage of his opinions. I have not met Mr. Le Baron since, but we have evidently arrived at very similar conclusions with reference to the canal location, and I wrote a letter, which was published sometime between January and July, 1893 (I cannot remember the exact date), which stated the possibility of an improved location.

I, of course, do not know the exact features of Mr. Le Baron's proposed location, but I am at least prepared to prove at any time that such a location as he indicates does exist on the ground, and is far superior to the Menocal location. I do not, however, limit myself quite to "no cutting over 10 ft. above water level."

I am prepared to maintain that the Menocal location has been grossly underestimated as to cost; that it is extremely dangerous and all but impossible of execution, especially the dams and embankments from Ochoa to the end of the summit level on the Atlantic side, and the great divide cut is an absolutely unnecessary absurdity; that the methods of dam and other construction proposed are simply ridiculous to any practical man who has been on the ground and seen the San Juan river, as both Mr. Le Baron and myself have been, and been over the ground pretty thoroughly, too, knee, waist and neck deep sometimes, in the mud; that the various consulting engineers who have reported on this location and approved it from time to time (however eminent and competent) have been entirely uninformed as to the actual conditions (though I do not say, designedly so, by the canal company), few, if any, of them having been in Nicaragua; that the surveys in possession of the canal company on which they reported, however perfect in detail as far as they go, are wholly one-sided and incomplete, as every engineer acquainted with the inside history of that company knows perfectly well. They were undertaken by Mr. Menocal to prove a foregone conclusion, based on a previous inaccurate reconnaissance (the Navy Report of 1885), and every effort made to really examine the ground with a view to finding the best possible route, was impeded to the extent of open rupture, even with so important and able a man as Lieut. R. E. Peary, of Greenland fame, as our chief of location. Points of the most vital importance, from an engineering point of view, were subordinated to the expediency of political considerations in the concessions which were muddled between the rival territorial claims of Costa Rica and Nicaragua, and are still so muddled.

I am, perhaps, more than Mr. Le Baron, an enthusiast on the Nicaragua route for an inter-oceanic canal, and have always been a friend of the company, holding my peace in the hope that a more appropriate time would come for correcting the location, without embarrassing with discussions the main question of raising the money, with a scheme which I believe to be first-class, both from a commercial and engineering point of view. As the point *has* been raised, I should like to see it fearlessly discussed, and the bill before Congress passed in some shape, but with the full knowledge on the part of the Representatives that much has yet to be done in the way of mature consideration before another four or five millions are wasted in utterly useless work on a wholly wrong location.

I know by heart every argument ever used by Mr. Menocal in favor of his location, as I was detailed to set forth its features as representative of the company at the Paris Exposition of 1883, and personally superintended the construction of the large plan in relief there exhibited, but it was never possible, as an employee of the company, to hint in the most distant way to Mr. Menocal that his location might be improved upon. He was too absolutely committed to it to permit such an "impertinence," even from Lieutenant Peary.

J. T. FORD, *Assoc. M. Inst. C. E.*,
Chief Engr. and Supt. C. & M. R. R.

A Balanced Locomotive.

CHICAGO, Feb. 27, 1895.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read in the *Railroad Gazette* of Feb. 22, 1895, a report on "A Balanced Locomotive," by Mr. George S. Morison, which intimates that locomotive designers pay no attention to the effect of the balance upon the track, and that the present practice of locomotive design is defective in this respect, and can only be remedied by the use of a 4-cylinder engine.

It is remarkable that Mr. Morison, who has been dealing with the track for a great many years, should have had his attention drawn to this disastrous effect of the balance on the track so recently, for we know that locomotives have attained speeds of 60 miles an hour in common practice as long ago as 20 or 25 years. The particular case which called Mr. Morison's attention to the subject was one in which the balance was very much in excess of any regular rules. Mr. Morison states that it is generally admitted that the present methods of counter-balancing are extremely defective. The most valuable opinions on this subject must be obtained from the locomotive builders, and the engineers in charge of the track. The locomotive builders, and master mechanics generally, do not admit that the regular methods of counter-balancing locomotives are extremely defective, and the engineers in charge of the track have not shown in any definite way that they are so. It cannot be said, therefore, that the general opinion of persons well informed condemns the present method of counter-balancing.

Mr. Morison says that he has found support for his opinion in the papers by Mr. D. L. Barnes and Prof. W. F. Goss, read at the Dec., 1894, meeting of the American Society of Mechanical Engineers. I have read Mr. Goss's paper carefully, and have discussed the subject with him, and he admits that the result obtained by his experiments with the wire on the Purdue locomotive wheels does not at all apply to good practice.

The first conclusion in his paper is that "wheels balanced according to usual rules are not likely to leave the track from the action of the counter-balance, and *can not do* so, unless the speed is excessive. The second conclusion is that wheels which carry a counter-balance of 400 lbs. in excess of that required for their revolving parts, may be expected to leave the track from the action of the counter-balance whenever their speed exceeds 310 revolutions per minute.

In Prof. Goss's paper, fig. 4, which illustrates the action of the main drivers, it will be found that little effect was produced on the wire by the counter-balance. The main wheels had an excess balance of 204 lbs., which is about 30 lbs. more than would be necessary on a well-designed engine of this size. The rear wheel, upon which the lifting action was observed, had an excess balance of 400 lbs., which is about 225 lbs. greater than good practice would provide. As Prof. Goss's experiment was made under abnormal conditions, which do not at all represent regular practice in counter-balancing, it cannot be said that his experiment or his conclusions show that present practice and regular rules for counter-balancing are defective.

I do not find in Mr. Barnes' paper anything which shows definitely that the present rules of counter-balancing locomotives are defective. He finally concludes that "the impact load, due to excess balance, is often double the static load." This may be true under the similar condition to Prof. Goss's, where excess balance was carried much greater than any rules provided, or it could only be true with proper balance, at speeds far in excess of those now obtained. He also states that about all that is known about impact pressure is that it is enough at times to bend a 70-lb. rail, and must refer to some unusual conditions, and not to any regular practice. I do not find anywhere in the paper that Mr. Barnes states that any injury could be done to the track under normal conditions, with wheels balanced according to the best current practice. Neither Mr. Barnes nor Prof. Goss can therefore be correctly quoted as admitting that present methods of counter-balancing are extremely defective, nor as having shown this to be the case in either of the papers mentioned.

In these days of enforced economy master mechanics are doing their best to make the simple engine more simple, and to reduce the number of parts to as few as possible. The proposition to use a four-cylinder engine with four pistons, piston rods, main rods, four sets of guides and other parts of the ordinary engine doubled for the purpose of reducing the variation in the pressure on the rail due to the counter-balancing, will not meet with much encouragement.

It is, I believe, admitted in Europe that crank axles are troublesome and objectionable, and instead of being common in European practice, I believe they are only generally used in England. They are not used to much extent in Germany, or Belgium, or Russia, or France, or Switzerland, or Austria. Outside cylinders and straight axles are, I believe, used on a large majority of European engines, and the tendency is for the number of outside cylinders to increase and of crank axles to decrease. But I do not believe that any large number of crank-axle locomotives will ever be built in this country.

The last part of the report states that large driving wheels will become unnecessary for high speeds, in the Strong four-cyliner engines. This must be on the supposition that the only way speed affects a locomotive is in the action of the driving-wheel balance, but I do not suppose it will be claimed that the centrifugal force, which increases, as is stated, with the square of the velocity, will not continue to put increased stresses in the main rods and connecting rods as speed increases, or that indicator cards will show as good a distribution of steam from the Strong four-cylinder engine at high speeds as at low speeds. I do not know of any serious objections to large driving wheels for high speed, as they reduce the number of revolutions for a given speed; they also reduce the stress in the rod and improve the distribution of the steam in the cylinders. That would seem to be a much simpler solution of the high speed problem, and of the varying pressures on the rail, due to the balancing, than the four-cylinder engines proposed by Mr. Morison.

SIMPLEX.

Notes on Modern Practice in Signaling.*

In opening, Mr. Gibbs disavowed any intention of treating the subject exhaustively, his object being to give such notes as would be of more particular interest to motive power men, who are interested in signaling through their relations with their subordinates, the

* Abstract of a paper by George Gibbs, Mechanical Engineer C. M. & St. P. Railway, read before the Western Railway Club, at Chicago, Feb. 19, 1895.

locomotive engineers. It is only very recently that operating men have come to agree that a signal should indicate the *absence* of danger, as well as its presence. The old argument that multiplication of signals would make runners careless has been exploded, and intelligent runners testify to the relief from nervous tension afforded by the removal of doubt at dangerous places on the road. Mr. Gibbs admits the strength of the theory that we ought to have a position signal at night, but notes the fact that, in consequence of the difficulties encountered, this ideal has been "temporarily abandoned," and he sees no violation of consistency in using color for night and form for day signals.

Touching upon the need of more than two colors at night, and the recent discussion on that subject, the speaker concludes that the best solution at present is red light, stop; green light, all clear; caution or distant signal, combination of red and green from one lamp (the Chicago & Northwestern practice). He thinks the predominating sentiment in the American Railway Association Committee is in favor of this arrangement. He finds an objection to a combination light in that it is possible for two separate signals, a red and a green, to be so placed that they would appear to an engineman as a cautionary signal, thus leading him to slacken speed only, when he ought to stop.

Mr. Gibbs thinks that a signal protecting a switch or crossing ought to be differentiated from one which is simply a block signal, where there are no switches, but he does not make any specific recommendation as to carrying out this idea, farther than to say that the C., M. & St. P. has partially accomplished it by giving a distinctive shape to its block signal arms. It is not stated how this distinction is made. When he comes to train order signals, which should be different from a block signal if anything should, Mr. Gibbs advises the use of a standard semaphore.

Mr. Gibbs thinks the automatic block system is the coming method of signaling. He goes on to describe the methods of working the block system, and refers particularly to the single track blocking of the Chicago, Milwaukee & St. Paul, which company now has 1,270 miles of single track blocks in operation. The traffic is handled with as much expedition as ever, and with much greater freedom from accident than under the order system; and Mr. Gibbs thinks the old system of despatching by train orders is likely to pass rapidly out of use.*

In the Western states, or in any region where the roads have a thin traffic and at the same time have large numbers of factories or other industries necessitating the establishment of private sidings, Mr. Gibbs deems permissive blocking a necessity, and to provide for such conditions he thinks the automatic block system is the best. Blocks should be made short enough to have a signal not far from each switch. The objection to automatic devices, that they get out of order is not necessarily an inherent one; the trouble comes from the general assumption that an automatic device will take care of itself, whereas nothing could be farther from the truth. If the care of an automatic signal is burdensome, the signal is unsuitable, otherwise it is not.

The staff system, which is in use on the C., M. & St. P., and the Kinsman system, which is, or has been, in use on the same road, were passed over with only one word, for lack of time.

*As the despatching system will always be necessary on single track for the purpose of arranging meeting points for trains it must be assumed that the speaker refers to its use as a preventive of rear collisions.

The Weaver Grate.

Railroads using anthracite coal have long searched for a grate that is durable and convenient for cleaning and dumping the fire. Most of the rocking grates that have been tried have failed on account of the burning and breaking of the bars in service. It is for this reason that most grates for hard coal are made of water bars, with alternate solid iron bars that can be pulled out to dump the fire. In the Weaver grate (as applied to the "274 class" of locomotives) shown by the illustrations, Figs. 1, 2 and 3, the water tubes are used only to fill up the fire box space laterally, and to allow for different widths so that the same grate pattern can be used for all sizes. This grate was first used by J. N. Weaver, Master Mechanic of the Lehigh Valley at the Sayre shops.

This form of grate is the most successful ever tried on the Lehigh Valley, and is best liked by the men. It is used in all new engines and for all old ones as they come in for general repairs. The cast bars are heavy, and but few have broken in service. The repairs are easy, as the grates are short, and to renew a grate it is only necessary to pull out the long bar that passes through the center and remove the old grate, and slip on a new one.

At the centre of the box there is a bearing bar which supports the bars and tubes. The cast bars, being keyed to the iron rods, can be turned by placing a lever on the back end. The grates are held from turning when in service by the clamp shown in Figs. 1 and 3.

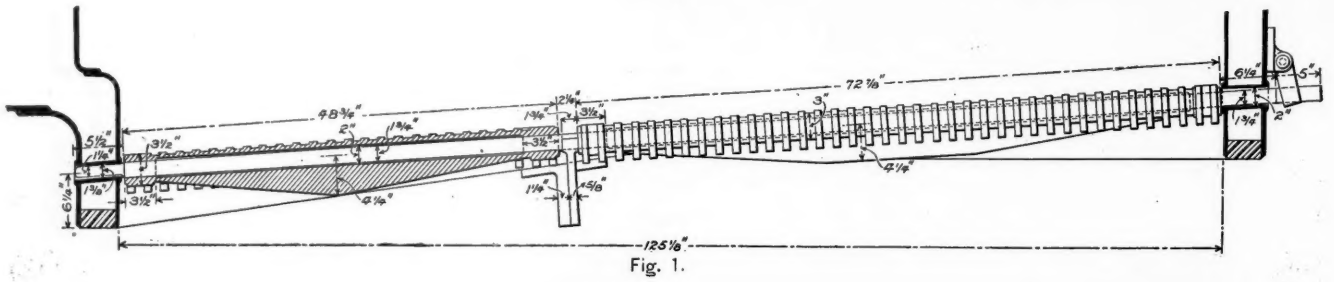


Fig. 1.

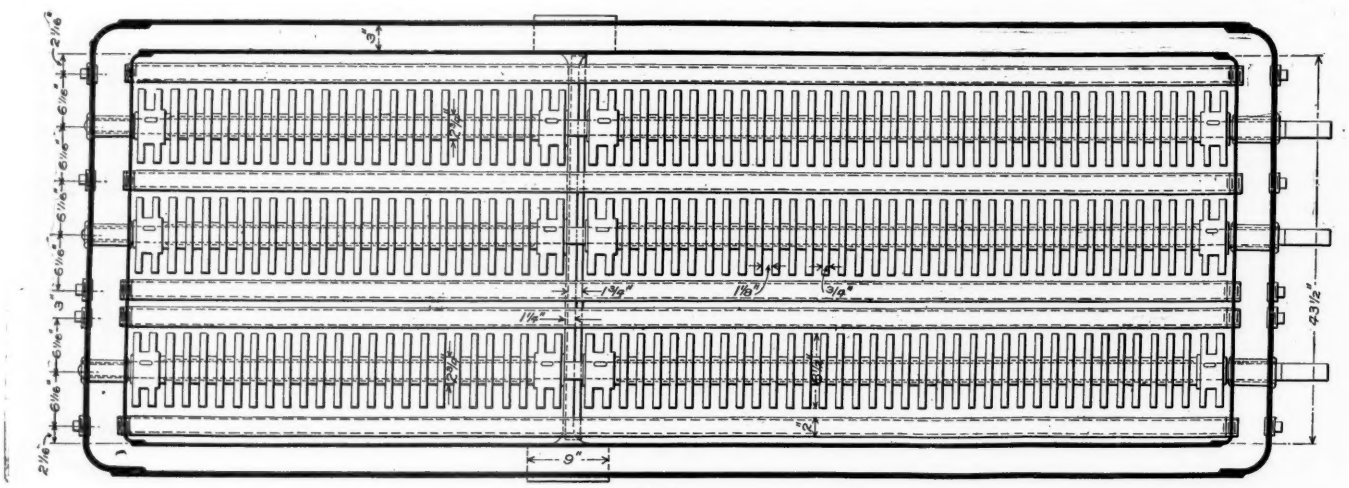


Fig. 2.
The Weaver Rocking Grate of the Lehigh Valley Railroad.

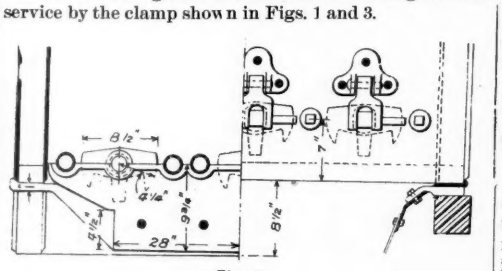


Fig. 3.

Mr. Higgins, the Superintendent of Motive Power, has found this grate so convenient and durable that its use is being continued on the new locomotives that are now building at the Baldwin Locomotive Works.

The Rules of Interchange.

At the February meeting of the Western Railway Club a committee made the following report on revision of the interchange rules:

We recommend that Rule 3 be changed to read as follows:

Cars may be refused for any of the following defects: If in the opinion of the road they are unsafe to run, or unsuitable for carrying freight, or if they have defects for the repairs of which the receiving roads are not authorized to bill.

Your Committee is of the opinion that this modification should be made, as apparently a great many Inspectors consider that cars should be refused for any of the defects mentioned in Rule 3, and do not take into consideration the question as to safety of the car.

It is recommended that Rule 4 be changed, and add after the words "cross-tie timbers."

"Such cards shall not be required for defects for which owners are responsible. In the case of missing material, the receiving road may require a defect card covering such missing material, which card shall be a voucher against Railroad Company furnishing card for scrap value of the missing material."

It is recommended that Rule 7 be amended to read as follows:

Locks, grain doors, and inside parts of cars, are at owner's risk.

It is recommended that Rule 8 be amended as follows:

Car owners shall be charged for the repairs of their own cars with the following exceptions:

(*a*) Damage caused by derailment, wreck, train parting, collision, fire, or evident carelessness in handling car shall not be chargeable to owners.

(*b*) Charges for damage to draft rigging and sills shall be made in accordance with the following; the parts referred to being:

1. Couplers, or drawbars.
2. Drawbar springs.
3. Drawbar pockets, spindles, or their substitutes, and followers.
4. Draw lugs and attachments, carry irons, and filling blocks.
5. Draw timbers or substitutes.
6. Deadwood or buffers.
7. End sills
8. Longitudinal sills.

Damage to any of the items above, numbered 1 to 8, shall not be charged for if accompanied with damage to other items, as follows;

1. If accompanied with damage to either 4, 5 and 7.
2. " " " " " 4, 5 and 7.
3. " " " " " 4, 5 and 7.
4. " " " " " 1, 2, 3 and 7.
5. " " " " " 1, 2, 3 and 7.
6. " " " " " 7.
7. " " " " " 1, 2, 3, 4, 5 and 6.
8. " " " " " 7.

(*c*) In the case of damage to longitudinal sills, bill shall not be rendered for more than two sills.

(*d*) No bill shall be rendered for more than two end or two corner posts on same end, or for more than one end or one corner post.

(*e*) Any damage caused by cornering or raking cars to be assumed by the company so damaging the car.

(*f*) In replacing brake shoes no labor shall be charged and no credit for scrap.

(*g*) Journal bearings needing renewal, no charge to be made for labor of renewing, and an arbitrary scrap credit shall be allowed for one-half the weight of the bearing applied.

(*h*) If repairs chargeable to owners exceed $5, notice descriptive of the same shall be sent at once to the owner of the car, and no bill shall be rendered for less than 25c.

It is believed that with the alterations as indicated above, roads will not be asked to pay for repairs to their own cars which have been caused by unduly rough handling, and that if the damage occurring is not in excess of the alterations made in Rule 8, the car owner is fairly responsible for the cost of making such damage good.

It is recommended to omit Rule 10.

It is recommended that the following be added to Rule 19:

"Evidence of wrong repairs having been made under Rule 8 will be authority for non-payment of bill, or for counter-bill, if bill has already been paid."

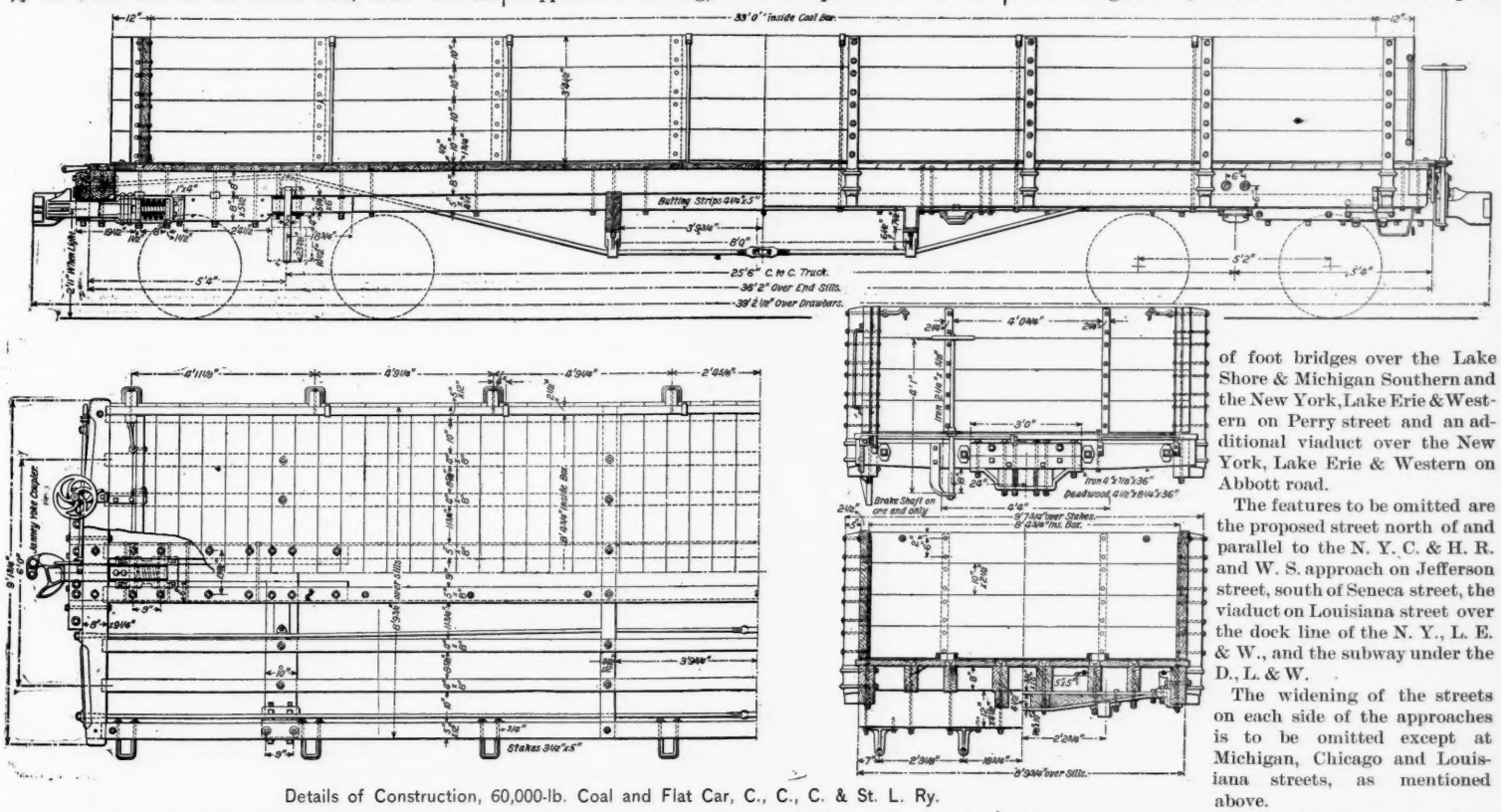
The committee consists of Messrs. J. N. Barr, G. W. Rhodes, C. A. Schroyer, P. H. Peck and A. M. Waitt.

The C., C., C. & St. L. 60,000-lb. Coal and Flat Cars.

Through the courtesy of Mr. William Garstang, Superintendent of Motive Power of the Cleveland, Cincinnati, Chicago & St. Louis Railway, we are enabled to give the drawings of their 60,000-lb. coal and flat cars of 1895 design. The construction of these two cars is identical, the side and end boards of the coal car being left off in the flat car.

These cars are of very strong build, as may be seen from the drawings. The side, center and intermediate sills are of long leaf yellow pine fitted to the end sills with 1½ × 1½-in. tenons, and let into the needle beams at the centre. The side sills are 5 × 12 in., the center 5 × 8 in., and the intermediate 4 × 8 in. The frame is strengthened longitudinally by 4½ × 5-in. white oak blocking

pieces extending from the body bolsters to the needle beams, and between the needle beams, and fastened to the center sills by ⅝-in. bolts. The end sills are 8 × 9¼ in. white oak, and are faced by 4½ × 8¼-in. white oak buffing blocks protected by a 4 × ⅜-in. iron strip. The needle beams are 4½ × 12-in. white oak chamfered and gained for all the sills. The truss rods, four in number, are 1⅛ in. in diameter, are supported beneath the needle beams and over the body bolsters by the usual brackets. The body bolster is iron and 10 in. wide, the tension and compression pieces being ¾ in. and ⅞ in. thick respectively. It is secured to the side sills by cast brackets, to the intermediate sills by ¾ in. bolts and to the center sills, draw timbers



Details of Construction, 60,000-lb. Coal and Flat Car, C., C., C. & St. L. Ry.

and center plates by ⅞ in. bolts. The flooring is 1¾ in. yellow pine, not less than 6 in. or more than 9 in. wide. The draft timbers are 6×8 in. white oak, fastened to the center and end sills by ⅞ in. bolts and furnished with a 5½ × 8 in. filling block. The draft springs have a double coil, the outer 1¼ in. round steel, the inner ¾ in. round steel, their capacity being 22,000 lbs. The Janney yoke coupler is used, and the center plates are of malleable iron. Pressed steel stake pockets are employed with 3½ × 5 in. white oak stakes fastened to each side board by two ⅝ in. bolts. The side boards are 2½ × 10 in. yellow pine raised ½ in. from the floor. The latest improved Westinghouse air brake is employed, the cars to be fitted with brake shafts at one end only.

A rigid truck is used with 4¼ × 8 in. journals and 5 ft. 2. in. wheel base. A 10½ × 12 in. white oak bolster is used, strongly trussed with two 1⅛ in. rods, carried on two struts spaced 15 in. between centres. The malleable iron centre plate is fastened by four ¾ in. bolts, extending down through the struts for truss rods. The bearing between the bolster column and spring plank is long, and there is a projection on this casting, to provide a bearing for the upper end of the brake hanger. The spring plank is a 12-in. steel channel weighing 30 lbs. per foot, and fastened to the bolster column by three ⅝ in. bolts at each end. Helical springs with pressed steel caps are used and an oak plank 1⅝ in. thick is put between the lower cap and spring plank. The arch and tie bars are 4 ins. wide, the former being 1¼ in. thick and the latter ⅝ in.; they are strongly connected with 1⅛ in. pedestal bolts and 1¼ in. column bolts, both of which have split keys at the bottom. The axles are of steel and have 4¼ × 8 in. journals. Standard M. C. B. journal boxes, with pressed steel drop lids and dust guards are employed. The brake rigging is exceptionally strong, the brakes being inside hung and provided with National hollow brake beams and Christie heads. The design of the cars, on the whole, is excellent and the liability of repairs is reduced to a minimum.

Fast Trains on Western Roads.

The fast mail trains now running over Western roads travel at speeds which compare favorably with the best Eastern trains, not excepting the Empire State Express. The Chicago, Burlington & Quincy train carries the trans-continental mail from Chicago to the Union Pacific transfer, 1.3 miles west of Council Bluffs. This train is made up of five mail cars and one express car, and is hauled from Chicago to Galesburg by a class H engine. This is a 19×24 in. mogul with 60-in. boiler, 69-in. drivers, and weighs in working order 125,000 lbs., of which 106,500 lbs. is in the drivers. The heating surface is 1,689.1 sq. ft., and boiler pressure 180 lbs. From Galesburg to the end of the run it is taken by class M engines 18×24 in., 8-wheelers, with 56-in. boiler, 69-in. drivers and weighing 100,000 lbs. each, 66,000 lbs. being on drivers. The weight of the train is 310 tons and an average load is 65 tons, making a total of 375 tons. Leaving Chicago at 3 a. m., the run to Galesburg, 162.5 miles is made in 3 hours 16 minutes, or at an average speed of 49.7 miles an hour. Deducting time for stops, the average running time is 51.9 miles an hour. This is the fastest time made over a division, the other times being: Galesburg to Ottumwa, 119.1 miles, at 41.7 miles an hour; rate in motion, 43.5; Ottumwa to Creston, 114.7 miles, at 42.2 miles an hour; in motion, 43; Creston to Council Bluffs, 102 miles, at 41.9 miles an hour. The average time over the whole run, 498.9 miles, is 43.8 miles an hour. One mail car is dropped at Galesburg, and the express car at Pacific Junction, 17.1 miles east of Council Bluffs. The Empire State Express runs from New York to Albany, 143 miles, in 2 hours and 45 minutes, or 52 miles an hour, no stops being made. Generally it has only four cars.

The Chicago & Northwestern also runs a fast mail train to Council Bluffs. This train consists of two mail cars and one express car and is drawn by a 17 × 24 in., 8-wheel engine, with 69-in. drivers, and weighing 84,800 lbs. This train also leaves Chicago at 3 a. m., making the run to Clinton, 138.1 miles, in 3 hours and 15 minutes, or 42.5 miles an hour. From Clinton to Belle Plaine, 115.9 miles, the speed is 46.3 miles an hour; Belle Plaine to Boone, 86.4 miles, 42.1 miles an hour; Boone to Council Bluffs, 148.1 miles, 43.5. For the whole run, 488.5 miles, the average speed is 43.2 miles an hour.

Abolition of Grade Crossings in Buffalo.

The plan for the abolition of grade crossings, as finally adopted by the Commissioners, covers approximately the same ground as was shown in the map and description published in the *Railroad Gazette* of May 6, 1892. It consists in raising or depressing the streets and tracks; at some places the change only being made in street grade, at others in the grade of both. Generally the streets, whether carried over the tracks by viaducts, or underneath by subways, are to be kept their present full width, necessitating the change of street grades on the approaches. In the original plan these structures were narrower, and land was to be purchased on each side of the approaches, giving access to adjoining property at present grade. Under the last plan this feature is to be continued only at Michican, Chicago and Louisiana streets. Four subways have been added along the line of the New York Central & Hudson River, and the street at first proposed along the north side and parallel to this road and the West Shore has been given up under the last plan; there is to be an additional viaduct over the New York Central & Hudson River, New York, Lake Erie & Western, and Lake Shore & Michigan Southern at Hamburgh street; there are to be two viaducts in place of foot bridges over the Lake Shore & Michigan Southern and the New York, Lake Erie & Western on Perry street and an additional viaduct over the New York, Lake Erie & Western on Abbott road.

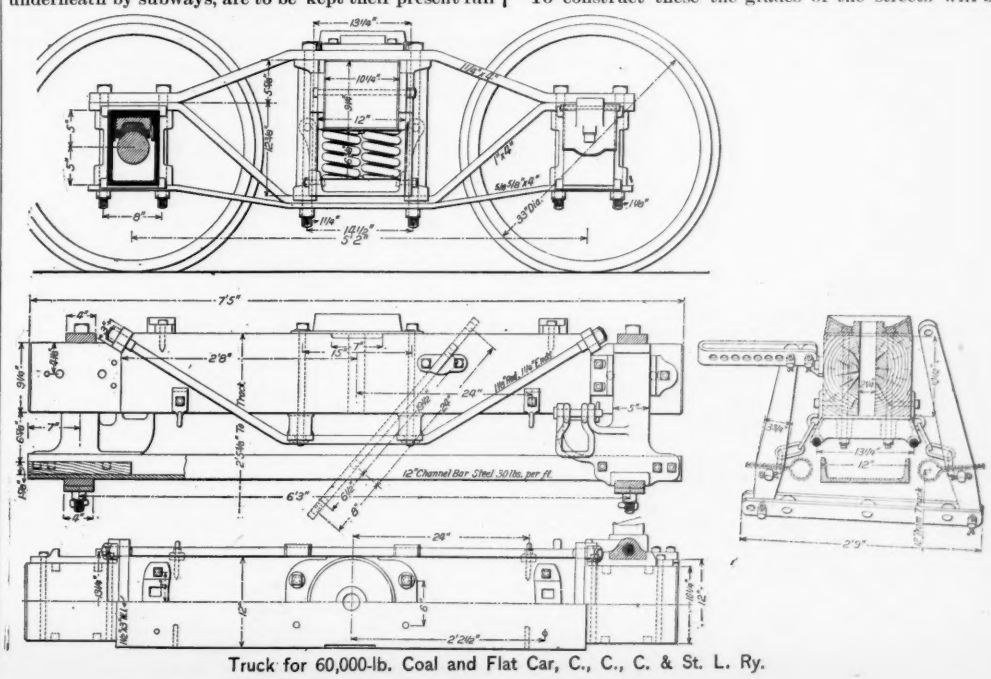
The features to be omitted are the proposed street north of and parallel to the N. Y. C. & H. R. and W. S. approach on Jefferson street, south of Seneca street, the viaduct on Louisiana street over the dock line of the N. Y., L. E. & W., and the subway under the D., L. & W.

The widening of the streets on each side of the approaches is to be omitted except at Michigan, Chicago and Louisiana streets, as mentioned above.

The following is a table showing the number of the various structures contemplated, together with the railroads interested in each:

Railroads.	Viaducts.	Subways	Foot bridge.	Open cut.	Streets closed.	Lift bridge.
N. Y. C. & H. R.	3	1	1	1	2	1
N. Y. C.: W. S.	2	.....	.....	.....	.....	.....
N. Y., L. E. & W.						
N. Y. C.: W. S.	1	.....	.....	.....	.....	.....
N. Y., L. E. & W.						
W., N. Y. & P.						
L. S. & M. S.						
N. Y. C.: W. S.	2	4	.....	.....	3	.....
W. N. Y. & P.						
N. Y. C.: W. S.	.....	7	.....	.....	8	.....
N. Y., L. E. & W.	5	2	.....	.....	4	.....
N. Y., L. E. & W.	1	.....	.....	.....	.....	.....
B. C.: W. N. Y. & P.						
W., N. Y. & P.	1	1	.....	.....	.....	.....
B. C.: W. S.	.....	1	.....	.....	.....	.....
L. S. & M. S.	1	.....	.....	.....	3	.....
L. S. & M. S.	1	.....	.....	.....	.....	.....
N. Y. L. E. & W.						
P. C.: N. Y. C. & St. L.	2	.....	.....	.....	2	.....
W. N. Y. & P.						
D., L. & W.	.....	3	.....	.....	.....	.....
Totals	19	19	1	1	22	1

To construct these the grades of the streets will be



Truck for 60,000-lb. Coal and Flat Car, C., C., C. & St. L. Ry.

changed and the clearances and widths will be as shown in the following table (in feet):

	Grades changed.	Clearance.	Widths.
Subways	5 to 15½	13	50 to 66
Viaducts	1.75 to 19.75	15 to 17	50 to 99
Ramps	.....	.....	24 to 66

In December last the Commissioners made a new contract with the N. Y. C. & H. R., covering not only the work to be done by that corporation alone, but also that in which the West Shore and other roads are interested. Contracts have also been entered into with the Lehigh Valley, and negotiations are under way with the other railroads interested.

By the terms of this contract the work to be done is divided into three classes. First, that on and along the property of the railroad, which is to be done and paid for wholly by the railroad. Second, that within the street lines, and limited by the property lines of the railroad extended across the street, which is to be done by the railroads and paid for wholly by them, when no other than the N. Y. C. & H. R. and West Shore companies are concerned, otherwise the work is to be done by the city, and the railroads are to pay their pro-rata share. Third, work along the approaches to be contracted for and performed by the city, except as specified in special cases, the cost of which is to be paid one-third by the city, two-thirds by the road or roads interested; where more than one is concerned this two-thirds is pro-rated according to their frontages on the street. The work to be done on the N. Y. C. & H. R. line from Michigan street west to the intersection of the Terrace and West Seneca street will soon be commenced. The balance of the Central's work cannot be undertaken until negotiations are completed with the other roads interested.

The work upon the line of the New York Central & Hudson River Railroad, from Michigan street west to the intersection of the Terrace and West Seneca street, for which bids have been asked, consists of three parts, that at Main street and the Terrace, that at Washington street and that at Michigan street. The first part will embrace the excavation, foundations and masonry for the two abutments of the beam tunnel or subway, and of the foot-bridge over Pearl street; the retaining walls on each side of the permanent location of the Central's tracks between the west end of the beam tunnel and West Seneca street, and the excavation of the material between the faces of the said abutments and retaining walls down to the sub-grade of the new roadbed of the railroad. While this work is in progress the railroad company will operate tracks supported on trestle work between Main and Washington streets.

At Washington street will be built foundations and masonry for the abutments of the bridge to carry Washington street over the tracks. The street will be closed during the work. Excavation will be done around the temporary trestle bents down to the grade of the new roadbed.

At Michigan street the work will consist of the construction of foundations, masonry and the excavation required for the piers on the north line of the N. Y. C. & H. R. Company's land; the piers south of the south line of Exchange street; and the rebuilding of the north abutment of the Hamburgh Canal bridge. A coffer dam will be built around this abutment, and if, when the water is pumped out, it is found to be in good condition it will be altered and not rebuilt.

We append a table showing the location and nature of the majority of the work embraced in the grade crossing plan, together with the proportion of the work falling to each railroad concerned. This schedule has been arranged beween the New York Central and the grade crossing commissioners, but has not yet been agreed to by the other roads concerned.

New ordinances are now under consideration for the operation of steam railroads in Buffalo, of which the following are principal points:

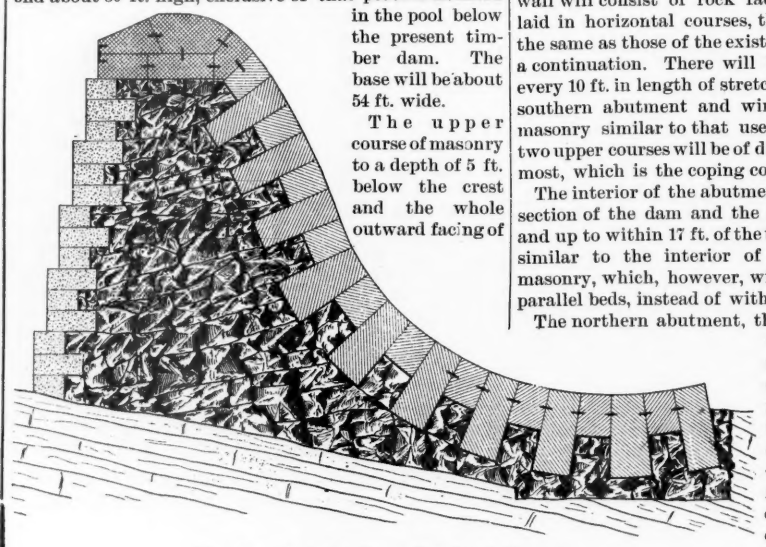
First, providing that trains shall not run faster than four miles an hour across certain streets, which, generally speaking, are those in which the grade crossings are to be eliminated under the present plan. On all other streets the speed is limited to six miles an hour. Second, trains are required to come to a full stop within 25 ft. of the street before passing over certain principal streets. Third, a certain date is fixed after which cars are not to be moved by steam over grade crossings embraced in the present plan. Fourth, railroads are required to remove their tracks from streets after a limited time, to be fixed later. Fifth, the Board of Public Works is to remove every track laid in or along public streets without lawful authority.

In addition to the above there are certain provisions with regard to penalties and certain exceptions to be made. Whether these will be passed, as here shown, or with modifications, is yet to be seen.

The New Holyoke Dam.

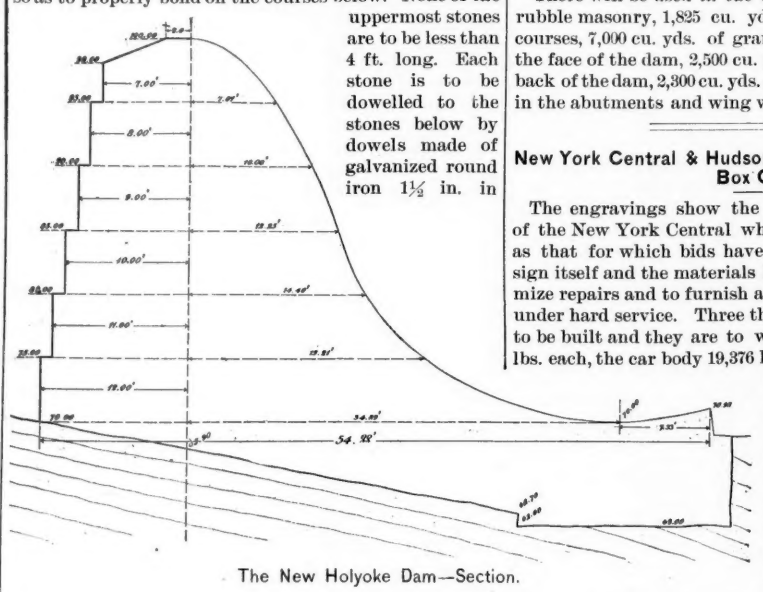
We mentioned last week a dam which is to be built across the Connecticut River at Holyoke, Mass., near the site of the existing structure. We give now some additional information concerning it, together with engravings showing its section and details of the masonry.

The work will consist of a masonry dam 1,020 ft. long and about 30 ft. high, exclusive of that portion situated in the pool below the present timber dam. The base will be about 54 ft. wide.



The New Holyoke Dam—Details of Masonry.

The upper course of masonry to a depth of 5 ft. below the crest and the whole outward facing of the dam will be built of first-class granite dimension stone, as shown in the engraving and of varying lengths, so as to properly bond on the courses below. None of the uppermost stones are to be less than 4 ft. long. Each stone is to be dowelled to the stones below by dowels made of galvanized round iron 1½ in. in diameter and 16 in. long. The stones are to be laid in full cement mortar, and all beds and joints are to be dressed for the full depth of the stone. No joints will exceed ¼ of an inch in thickness. The cement used will be Portland cement, and the mortar will be a mixture of one part of cement and two parts of sand.



The New Holyoke Dam—Section.

The concrete used will be broken stone and mortar, five parts of broken stone not over 2 in. diameter to one part of cement in the mortar used.

The facing stones, from the upper courses above described to the foot of the curved surface, are to be of similar granite to the upper courses and will be laid in regular courses composed of two stretchers and one header alternately, except the lower course, which will be all headers. These stones will be about 6 ft. 8 in. long, 3 ft. 4 in. wide and 2 ft. 6 in. high.

Rubble stone masonry without regular courses is to be used for the interior portion of the dam and abutments, as shown in the engraving.

The back of the dam is to be built of split granite laid in horizontal courses with joints not exceeding ⅛ in. in thickness. One-fifth of this face is to be headers 4 ft. long.

The outer face of the southern abutment and wing wall will consist of rock face granite dimension stone laid in horizontal courses, the rise of each course to be the same as those of the existing abutment of which it is a continuation. There will be at least one header for every 10 ft. in length of stretchers. The inner side of the southern abutment and wing wall will be faced with masonry similar to that used upon the outer side. The two upper courses will be of dimension stone. The uppermost, which is the coping course, will be of large stone.

The interior of the abutment, the space covered by the section of the dam and the inner wall above the dam and up to within 17 ft. of the top, will be built of masonry similar to the interior of the dam—that is, rubble masonry, which, however, will be laid in courses, with parallel beds, instead of without courses.

The northern abutment, the waste way and the river wall are to be built of masonry similar to that of the southern abutment. On the top of the waste way a course of stone 40 ft. in length, 4 ft. in width and 2 ft. in depth will be required. The wing walls descend from top to bottom in steps varying in depth according to the different courses. Each step will be coped with a granite block 6 ft. long.

There will be used in the dam about 34,500 cu. yds. of rubble masonry, 1,825 cu. yds. of granite in the upper courses, 7,000 cu. yds. of granite dimension masonry in the face of the dam, 2,500 cu. yards of split granite in the back of the dam, 2,300 cu. yds. granite dimension masonry in the abutments and wing walls.

New York Central & Hudson River Railroad Standard Box Car.

The engravings show the standard 60,000 lb. box car of the New York Central which is essentially the same as that for which bids have just been asked. The design itself and the materials have been selected to minimize repairs and to furnish a car that will stand up well under hard service. Three thousand of the new cars are to be built and they are to weigh approximately 30,000 lbs. each, the car body 19,376 lbs. and the Fox trucks estimated at 10,624 lbs. There are some special features to be noticed in these cars. The end framing, including the end-plate, 3 x 13 ins., the end belt-rail 4 x 6 ins., and the base-blocks, 4 x 6 ins., are unusually heavy and are securely bound at the corners by outside and inside corner-plates. The end-sill is 8 x 10¾ ins., and the body-bolster is 16 x 6⅛ ins., with two iron flitch-plates ½ x 6 ins. The bolster is also

BUFFALO GRADE CROSSING IMPROVEMENT.—CONSTRUCTION SCHEDULE AS PER CONTRACT OF NOV. 30, 1894.

Location.	Type of Structure.	Corporation to contract for or execute.	Railroad companies concerned, and proportion of cost to each.						"Approaches" to be contracted for by the city and cost apportioned, as follows:						
			N. Y. Central.	West Shore.	Lake Shore.	Erie.	W. N. Y. & P.	City of Buffalo.	N. Y. Central.	West Shore.	Lake Shore.	Erie.	W. N. Y & Pa.	B. C.	City of Buffalo.
Terrace and Main St.	Open cut, beam tunnel and Pearl St. foot bridge	N. Y. C. R. R.	All												1/3
Washington Street	Bridge	N. Y. C. R. R.	All												1/3
Michigan Street	Viaduct	N. Y. C. R. R.	All												1/3
Chicago Street	Viaduct	City of Buffalo	58.37	16.43		14.87									1/3
Louisiana Street	Viaduct	City of Buffalo	20.20	8.56	8.20	42.84		20.20							1/3
Hamburgh Canal	Lift Bridge	N. Y. C. R. R.	All												
Jefferson Street	Viaduct	City of Buffalo	56.16	15.83			28.01								
Seneca Street	Viaduct	City of Buffalo	56 16	15.83			28.01								
Hamburgh Street	Viaduct	City of Buffalo	16.53	5.44	33 43	12.65	20.02	11.93	1/3	1/3	1/3	1/3	1/3		
Swan and Seymour Strs.	Subway	N. Y. C. R. R.	70.49	10.63			18.88								
South Division Street	Subway	N. Y. C. R. R.	60.43	29.89			9.68								
Eagle Street	Subway	N. Y. C. R. R.	66.84	33.16											
Emslie Street	Subway	N. Y. C. R. R.	44.05	28.85			27 10								
North Division Street	Subway	N. Y. C. R. R.	42.39	28.92			28.69								
Lord Street	Subway	N. Y. C. R. R.	66.84	33.16											
Clinton Street	Subway	N. Y. C. R. R.	66.84	33.16											
Oneida Street	Subway	N. Y. C. R. R.	66.84	33.16											
Smith Street	Subway	N. Y. C. R. R.	66.84	33.16											
Fillmore Avenue	Subway	N. Y. C. R. R.	68.15	31.85											
Howard Street	Subway	N. Y. C. R. R.	45.91	54.09											
William Street	Subway	N. Y. C. R. R.	All												
Clinton Street	Subway	City of Buffalo		31.96				B.C. 68.04		1/3				1/3	

trussed with rods and saddle-straps. This double reenforcing is to make the car a strictly center-bearing structure, and with the Fox truck, which is supposed to give no deflection, it should fully accomplish that end.

The center sills are strengthened by buffing subsills or back-stop timbers, two draft rods connecting the draft timbers with the cross-tie timbers. The car would have been better strengthened to resist draft if the two cross-tie timbers were also connected by similar tie-rods, thus making the draft gear continuous. The sub-sills are bolted to the center sills and secured by a key or packing blocks, as shown.

The general dimensions are slightly greater than the average for new box-cars. The inside dimensions are 34 ft. 4⅛ ins. x 8 ft. 3¼ ins., and the clear height is 7 ft. 1¼ ins. The car inside is 1 ft. 7 ins. shorter than the Pennsylvania standard, and 3 ft. 11 in. shorter over the end sills.

The under frame is of Georgia and Norway pine, except the end sills, bolsters, cross-tie timbers and draft timbers. The sides, ends and roof are of oak, except the long pieces, which includes the plates, roof-binders, ridge-pole, purlins, facia and running boards, which are of Georgia and Norway pine. The roof boards, sheathing and doors are of white pine.

There may be economical reasons for carrying the sill and plate rod through the cross-tie timbers, but the construction is not general. If the cross-tie timbers be knocked out in derailment or wreck and the bolts broken, it leaves the car without any trussing for two or three panels, the body truss rods and side framing both being crippled. Then to make repairs, the roof must be torn up to get the rod out.

The cross-tie timbers are placed nearly under the door posts, where they should be placed, at the weakest point of the side framing.

The appliances named and specified for the latest order are the following: Dunham door fixtures, Fox trucks, Gould couplers, Kimball turnbuckles, McGuire grain doors, Vose springs warranted for five years, Westinghouse air brakes and the New York Central standard draft gear, steel brake beams and uncoupling apparatus. The builder is required to protect the railroad company from all patent right claims.

These cars are calculated to carry 1,000 bushels of wheat, and the end framing has been made especially heavy to prevent bulging and wrecking by bulky freight, which is liable to shift its position. The Central has had some experience with hogsheads of sugar, and the effects of them on the ends of its cars, and this end has been designed to meet such service

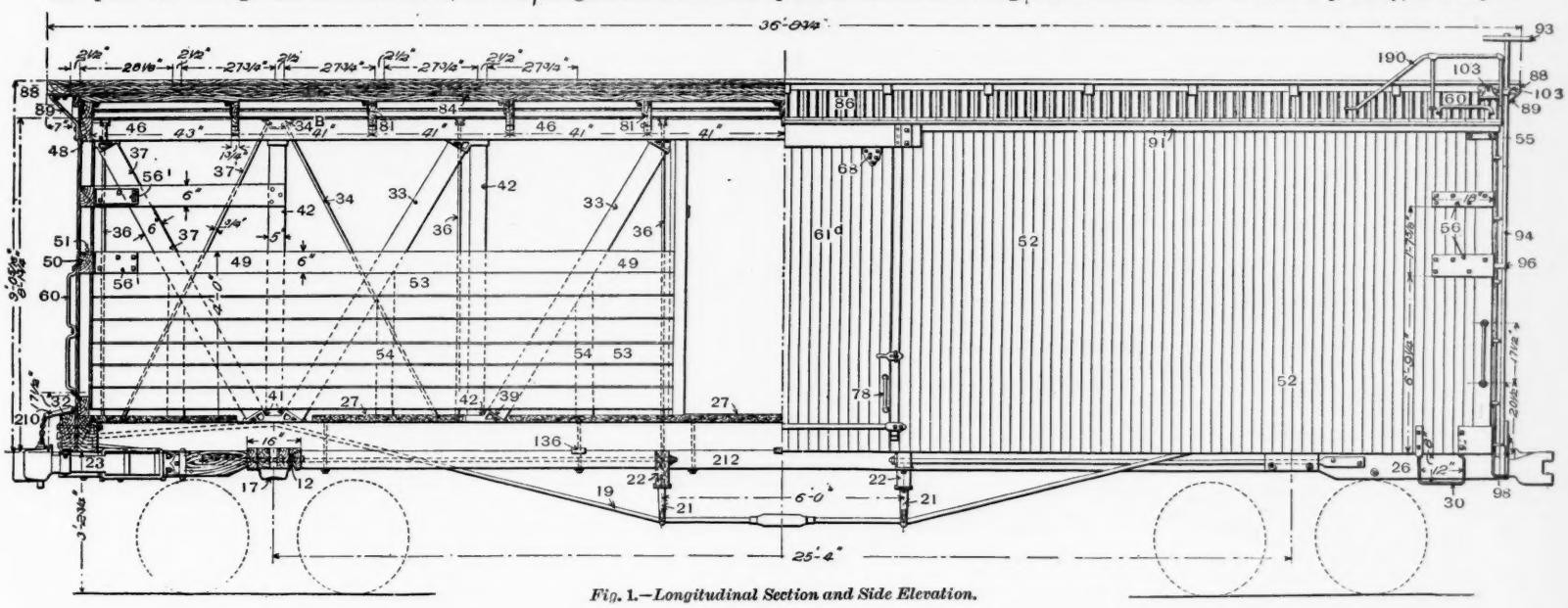


Fig. 1.—Longitudinal Section and Side Elevation.

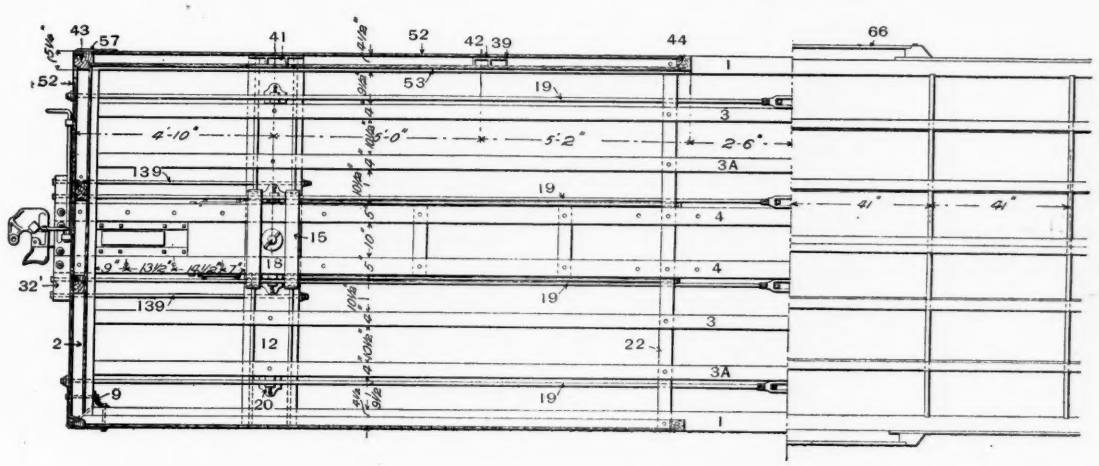


Fig. 2.—Half Plan of Side Framing and Part Plan of Roof Framing.

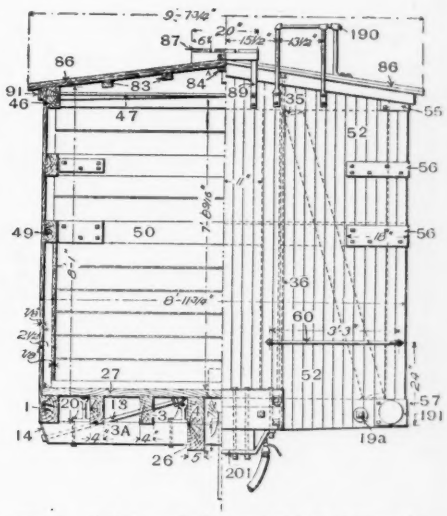


Fig. 3.—Half Cross Section and Half End Elevation.

The Standard Box Car of the New York Central & Hudson River Railroad.

(Plates from the New Edition of the Car Builder's Dictionary.

The Hudson River Bridge Specifications.

The Board of Directors of the New York and New Jersey Bridge Company, met at the company's office, 214 Broadway, on Tuesday, March 5. Mr. Theodore Cooper, a member of the commission of expert bridge engineers, appointed by President Cleveland, and who has since been retained by the New York and New Jersey Bridge Company, presented general specifications for the suspension bridge over the Hudson River, and said among other things:

"In preparing the general specifications, herewith presented, I have had in view two principal objects: first, a clearly defined statement of the required capacity and strength of the proposed structure, as upon these points bidders should not be allowed any latitude of variation; second, the allowing bidders as much latitude of design and proportions as is consistent with the first object.

"The main purpose for building this bridge is to get a paying revenue by transferring the traffic of the railroads on the west bank of the Hudson River to the City of New York. A bridge incapable of satisfying the traffic demands of these railroads could not be a financial success.

"Such a bridge should not be built for the present only, nor should a false economy cause this bridge to be designed and constructed upon the idea of restricting the speed size, weight or frequency of the trains. You could not afford to tell any of these railroads, by signals or otherwise, that another train cannot be allowed upon the bridge because it was not built strong enough. The specifications are therefore drawn to rule out any plans which may be presented as cheap structures.

"In selecting the kind of wire to be used, I have been governed by the desire to obtain the largest practicable wire of great strength that could readily be obtained from the larger existing wire manufacturers, without undue cost. The replies received in answer to my inquiries satisfy me that the requirements of the specifications in reference to the wire can be filled by a sufficient number of makers to obtain a desirable competition.

"Under these specifications you should be able to get an active competition for the construction of the proposed bridge from parties not only competen to design such a structure but capable of executing the contract for the same."

The treasurer of the company, Mr. Swan, then said: "We shall advertise for proposals for a suspension bridge upon the specifications presented by Mr. Theodore Cooper, and the company will require guarantee bids accompanied by a suitable bond that the work will be finished at the price and within the time called for."

We give below the specifications. They define the capacity, strength and legal restrictions under which the bridge is to be built. Upon all points where the bidder is at liberty to seek the best and most economical design, they are intentionally made very general.

Before the acceptance of any proposal, detail specifications defining the methods proposed by the bidder, and which must be at least equal to the best practice of the day, will be prepared to supplement these general specifications.

GENERAL SPECIFICATIONS, HUDSON RIVER BRIDGE.

Location.—The bridge will be located at such points, between Fifty-ninth and Sixty-ninth streets, New York City, as may be approved by the Secretary of War. See accompanying plan and profile.

Span and Elevation.—The bridge will have a clear span of 3,100 ft., the piers being located inside of the pier-head lines. The elevation shall be such that the bridge shall afford, under any conditions of load or temperature, a clear headway above high water of spring-tides of not less than 150 ft. at the center of the span.

Capacity.—The bridge will have six standard railroad tracks upon one level.

General Description.—The general type of the proposed bridge will be a steel wire suspension bridge, stiffened for moving load by longitudinal girders extending from tower to tower. The main span only, or that portion between the towers, will be carried by the cables. The side spans, or that portion between the towers and anchorages will be carried upon viaducts, independent of the cables. The towers will be steel skeleton structures, commencing at an elevation about 50 ft. above high water, where the masonry piers end. All the connections must be riveted, and all the bracing must be rigid.

The stiffening trusses will be riveted lattice girders, with multiple systems of diagonal web bracing. They may be made continuous from tower to tower, or they may be made with a central hinge, at the option of the bidder.

All the lateral and sway bracing of the main span and the towers will be formed of rigid members, capable of resisting either tension or compression.

The transverse and longitudinal floor beams will be riveted plate girders; there must be two longitudinal girders under each track.

The anchorage bars will be eye-bars of medium steel.

The anchorage pedestals will be built from forms of medium steel, and will rest on dressed granite blocks carefully bonded into the adjoining masonry.

Each bidder can select such depth of versine, number and arrangement of cables, depth of stiffening trusses and general details as he may deem best, within the requirements of these specifications.

The main piers and the anchorages will be founded upon the rock. The viaduct piers may be founded upon the rock, or upon piles, or such other form of foundation as may be approved by the Chief Engineer.

Bidders must submit with their proposals plans for

the anchorages and piers, showing the proposed methods of founding, their general construction, and the character of the masonry. The exposed faces of all masonry will be of granite or other approved stone.

LOADS.

The structure shall be proportioned to carry the following loads:

First.—The weight of rails, ties, guards, footwalks, etc., above the longitudinal track girders, shall be taken as 400 lbs. per lineal foot of each track.

Second.—The weight of metal in the structure.

These two items, taken together, shall constitute the "dead" or "permanent" load.

Third.—Trains weighing 3,000 lbs. per lineal foot of track, covering all the tracks from tower to tower, at rest or moving slowly.

Fourth.—Trains 1,000 ft. in length and weighing 3,000 lbs. per lineal foot upon each of the six tracks; these trains being supposed to be moving at high speeds, either all in one direction, or the three on the north tracks in one direction and the three on the south tracks in the opposite direction.

Fifth.—For the floor girders and other members, which will get their greatest stress from engine loads, a uniform load of 3,000 lbs. increased by a concentrated load of 50,000 lbs., upon each track. Items 3, 4 and 5 will be known as the "live" loads.

Sixth.—Wind: The structure covered with trains of cars will be assumed to be acted upon by a wind force of 25 lbs. per square foot of surface; or a wind force of 100 lbs. per square foot of surface of the bridge only, for a length of 300 ft. The wind will be supposed to act either horizontally or at an angle of 30 deg. above or below the horizontal; but the horizontal component only need be considered.

Seventh.—Temperature: A range of temperature of 75 deg. Fahr., above and below the mean, shall be considered in proportioning all parts of the structure.

The modulus of elasticity of the cables will be assumed as 30,000,000 lbs., and for the trusses and other parts made from structural steel as 28,000,000 lbs.

The coefficient of expansion for steel will be assumed as 0.0005 for 75 deg. Fahr.

All parts of the structure shall be proportioned to meet the maximum conditions produced by combination of the "dead" load with either of the "live" loads 3, 4 or 5, the wind and temperature.

ALLOWED UNIT STRAINS.

Members Subject to Tension.—Cables.—Under the above-specified loads, the allowed tension upon the wires in the cables shall not exceed a maximum of 54,000 lbs. per square inch.

Suspenders.—The allowed tension in the suspenders shall not exceed 30,000 lbs. per square inch of the section of the wires.

Cross-Stays.—The wire ropes used for staying the cables together may be strained to 60,000 lbs. per square inch of the wires.

Anchor Bars.—The anchor bars may be strained to 20,000 lbs. per square inch.

Floor Hangers, etc.—Forged steel hangers and similar members shall not be strained more than 7,500 lbs. for "live" loads, and 15,000 lbs. for "dead" loads.

Floor Girders.—These girders shall be proportioned upon the supposition that the bending or chord strains are resisted entirely by the upper and lower flanges, and that the shearing or web strains are resisted entirely by the web plates. No part of the web plate shall be estimated as flange area.

Under these conditions the lower flanges of the longitudinal floor girders shall not be strained above 10,000 pounds per square inch of net section.

The lower flanges of the transverse floor girders, when subject to tension only, shall not be strained above 15,000 pounds per square inch of net section.

The top flanges of such girders will be made of the same gross section as the lower flanges, but the flanges must be stayed against transverse crippling at distances not exceeding twenty times their width.

Stiffening Trusses.—The chords of the stiffening trusses, when subject to tension only, shall not be strained above 18,000 lbs. per inch of net section by the live loads, nor more than 22,500 lbs. by the combined action of live loads, temperature and wind.

Tension members of the lateral and sway systems shall not be strained in tension above 18,000 lbs. per square inch of net section.

Members Subject to Compression.—The columns of the towers shall be so proportioned that the maximum compression per square inch will never exceed that given by the following formula:

$$P = 20{,}000 - 70\,\frac{l}{r}$$

For the compression struts in the lateral or sway system of bracing, the unit strain must not exceed:

$$P = 17{,}5000 - 75\,\frac{l}{r}$$

Where P = allowed unit strain
l = length in inches.
r = least radius of gyration in inches.

The chords of the stiffening trusses, when subject to compression only, shall not be strained by live loads above:

$$P = 17{,}500 - 60\,\frac{l}{r}$$

nor by the combined action of live loads, temperature and wind above:

$$P = 22{,}500 - 80\,\frac{l}{r}$$

Members Subject to Reversal of Strains by Live Loads.—Under the reversal of strains by live loads, the chords of the stiffening trusses shall not be strained above the unit strains given by the following formulæ:

$$t = \frac{T}{T + aC}\,20{,}000$$

$$c = \frac{aC}{T + aC}\,(20{,}000 - 70\,\frac{l}{r})$$

And the web diagonals of the stiffening trusses by the following:

$$t = \frac{T}{T + aC}\,18{,}000$$

$$c = \frac{aC}{T + aC}\,(17{,}500 - 75\,\frac{l}{r})$$

Where t = allowed tension per square inch,
c = allowed compression per square inch,
T = total tension on the member,
C = total compression on the member,
a = value of the net section in terms of the gross section.
l and r as before.

Should the transverse floor beams be subjected to reversal of strains, the allowed unit strains will be reduced in like manner.

Shearing Strains and Bearing Pressures.—The shearing strain and bearing pressures upon the rivets or pins connecting any members shall never exceed 75 per cent. and 150 per cent., respectively, of the maximum allowed tension or compression on these members for any particular loading.

Pins shall not be subjected to a greater bending strain than 18,000 lbs. per square inch, under the assumption that the middle halves of the bending surfaces of the several members are considered as uniformly loaded with the applied forces. The webs of plate girders must be stiffened, at intervals not exceeding the depth of the girders, wherever the shearing strain is greater than that given by the following formula:

$$s = \frac{12{,}000}{1 + \frac{H^2}{3{,}000}}$$

where H = ratio of depth of web to its thickness.

Masonry.—The pressure transmitted to the masonry by the towers or anchor pedestals shall not exceed 40,000 lbs. per square foot of surface under the maximum possible loading. The pressure within the masonry or upon the rock foundation shall not exceed 20,000 lbs. per square foot, after allowing for displacement of the water, silt and sand; the weight of water being taken at 63 lbs., silt at 100 lbs., and sand at 120 lbs. per cubic foot.

The pull of the cables must be resisted by that part of the anchorage masonry which is above mean high water, and its value for this purpose will be determined by the following factors: Weight per cubic foot of masonry to be taken as 150 pounds; coefficient of friction as 0.6; factor of stability as 2.

DETAILS OF CONSTRUCTION.

The arrangement of the anchorages must be such that all parts of the cables, anchorage links and pedestals, other than the pedestal bearings, shall be readily accessible for inspection, cleaning and preservation.

The towers and cables must be treated on the supposition that the saddles are or may become immovable.

The effects of the wind upon the cables may be provided for by cradling the cables and staying them together. The effects of the wind upon the floor and trusses must be provided for by a suitable system of lateral and sway bracing between the chords of the stiffening trusses.

The suspenders may be made of wire ropes, or cables of straight wires, suitably wrapped.

The cables must be so arranged that those on each side will be equally strained under any loading.

The stiffening trusses shall be given a camber of 5 ft. when at their lowest position from load and temperature.

No compression member with a length greater than 125 times its least radius of gyration will be allowed.

No plate or shaped forms of steel of a less thickness than ⅝ of an inch shall be used.

All details and connections shall be of such proportions that upon testing to rupture they may be of equal strength to the members they connect.

All parts must be accessible to cleaning, painting and inspection.

No closed forms will be allowed.

Wherever it is possible, all rivets must be driven by power riveters.

All bearing surfaces and abutting joints must be accurately tooled.

All details of the structural work and all methods of manufacture must be equal in character to the best practice in American bridge work.

All the wires in the cables must be carefully and accurately adjusted for the positions they will finally occupy in the finished cables.

The wires in each strand must be continuously spliced. The length of the wires shall be so arranged that the splices will be uniformly distributed throughout the strands and cables.

The splices must be satisfactory to the engineer, but a splice which will give 75 per cent. of the strength of the wire without any enlargement at the splice will be considered preferable to one which creates an enlargement with a greater percentage of strength.

The wires of each cable must be thoroughly compacted into a cylindrical form, saturated with a selected preserving preparation, and then closely and firmly bound together by a wire wrapping put on in the most approved manner. Parts inaccessible to the wrapping process must be protected to the satisfaction of the engineer.

The unprecedentedly large diameter of the cables for a bridge of the size of this structure will demand that the strands be squeezed together and wrapped in two or more processes, the inner strands being treated as a separate cable, around which the additional strands will be placed, squeezed and wrapped. The number of these processes shall be determined by the engineer after the size and manner of making the cable have been selected.

The pull of the suspenders in the direction of the cables must be taken up otherwise than by the friction of the cable bands produced by bolts through their flanges. Only 20 per cent. of the normal pressure upon the cables, produced by the load on the suspenders shall be considered as resisting this pull. The remainder must be taken up by supplementary cables or ropes, running from the saddles to the suspender connections, or some equally acceptable device.

MATERIALS OF CONSTRUCTION.

Masonry.—The kind and quality of all stone, cement, sand and other materials used in the foundations or the masonry must be to the satisfaction and approval of the engineer.

The masonry of each part of the work shall be thoroughly compacted and cemented into one solid mass free from voids, and each class of masonry shall be in all particulars fully equal to the best accepted practice of the day for its class.

For the main piers, where great strength is desired, the selected kind of masonry must be made of such materials and be so bonded that the required strength will be obtained.

For the anchorages, where weight of masonry is the more important element, a cheap class of masonry may be used for the interior, but externally this masonry must be of granite or other selected stone of such forms, dimensions and projections as will give a suitable appearance for a work of this magnitude at this location.

Each bidder must clearly specify the kind and quality of masonry proposed for each part of the work.

Built Structural Work.—The stiffening trusses, floor, bracing, towers, anchor bars, pins, hangers and pedestals will be of "Medium Steel," which shall have an ultimate strength of 60,000 to 68,000 lbs. per square inch, an elastic limit of not less than 33,000 lbs., and a minimum elongation of 20 per cent. in 8 in., when tested by samples cut from the finished bars, having a length of 12 in. and a uniform sectional area of ½ sq. in.

Before or after heating to a low cherry red and cooling in water at 82 deg. Fahr., this steel must stand bending to a curve whose inner radius is one and a half times the thickness of the sample, without cracking.

The finished bars, plates and shapes must be free from cracks on the faces and corners and have a clean, smooth finish.

All sheared edges of plates and other forms must be planed off to a depth of ¼ in. All rivet holes must be drilled after the several pieces forming one member are assembled together, or they may be punched, and, after assembling, reamed to a diameter ⅛ in. larger.

All forged work must be finally annealed.

All rivets shall be of soft steel.

The saddles may be steel castings.

Wire.—The wire for the cables shall not be less in diameter than No. 3, Birmingham gauge, or 0.259 in.

It shall be bright, "straight" wire, free from any tendency to coil when unrolled. Machine straightened wire will not be accepted. It must be perfectly free from nipper marks.

It must have an ultimate strength per square inch of 180,000 lbs., an elastic limit of 90,000 lbs. per square inch, and an elongation of 4 per cent. in a length of 1 ft.; it must stand wrapping around a rod one-half inch in diameter at least four turns without evidence of fracture.

Each wire must have a minimum length of 1,800 ft. without weld, joint or splice.

A variation in diameter not exceeding 0.006 in. will be permitted in the length of one wire, and a variation of the minimum size of the various wires not exceeding 0.002 in.

All wire as soon as made must be passed through an approved preparation of linseed oil to protect it from oxidation.

After testing and acceptance of the coils, they will be jointed and coiled upon suitable drums for transportation, in lengths as great as can be practically handled or transported.

The drums must be of such a diameter as not to injure the straightness of the wire.

All the wire shall be subject to the following tests:

1st. Each ring may be tested for tensile strength, elastic limit, elongation and bending, by samples cut from either end of the wires.

Or, 2d. Upon satisfactory evidence that the stock and method of manufacture are uniform, one wire from each forty may be selected as the basis of acceptance or rejection of the whole forty.

In this case a length of wire of 40 ft. may be cut from any part and subjected to test. Such piece must show an ultimate strength of 180,000 lbs. per square inch, an elongation over its whole length of 2 per cent., and an elastic limit not less than 90,000 lbs. per square inch. It must also answer the requirements of the wrapping test.

3d. More frequent tests than the above may be made by direction of the engineer, but for such additional tests the loss of the material and expense of testing shall fall upon the bridge company in case the wire complies with the specifications; otherwise they shall be at the contractor's cost.

The wrapping wire will be No. 8 B. W. G. for the external wrapping, and No. 10 B. W. G. for the internal wrappings.

It must be annealed steel wire, and have an ultimate strength of not less than 80,000 lbs. per square inch.

If the suspenders are made from straight wires wrapped, the wire must not be less in size than No. 6 B. W. G. and be equal in quality to the wires of the cables.

If the suspenders are made from wire ropes, the ropes must be of steel wire, with a wire core. The ropes must have an ultimate strength of 180,000 lbs. per square inch of the cross-section of the wires and an elastic limit of at least 90,000 lbs. The wires must not be less than No. 10 B. W. G., and must stand wrapping around a ½-inch rod, and being unwrapped without fracture.

INSPECTION AND TESTING.

The contractor for any class of work under these specifications must furnish all proper facilities for the inspection of all materials and workmanship. He must supply and operate the necessary testing machines, and furnish the required specimens without charge.

Full-sized members may be tested to destruction at the option of the engineer, but such material shall be paid for at cost if it fulfills the specification requirements, otherwise it will be at the loss of the contractor.

PAINTING.

All the structural work before leaving the shop shall be thoroughly cleaned from all scale and rust by means of wire brushes, and then be given one good coat of a selected preparation made with pure linseed oil, well worked into all joints and open spaces, so as to render them watertight. In riveted work the surfaces coming in contact shall each be painted before being riveted together. All surfaces which will not be readily accessible, after the work is erected, must be given two coats.

After the work is erected it shall be thoroughly and evenly painted with two additional coats of such compo sition and color as may be directed.

All the wire work shall be fully saturated with a preparation of linseed oil as the work progresses. After completion all recesses where water could lodge or enter must be thoroughly protected by a suitable waterproofing material. The work shall then be given two coats of paint.

PLANS AND STRAIN SHEETS.

Proposals must be accompanied with strain sheets, general plans, representative details and such detail specifications as will clearly and definitely show the strength and character of the proposed plan and the methods to be employed in its construction.

"All the plans and specifications, with the necessary drawings of said bridge, shall be submitted to the Secretary of War for his approval, and before such approval the construction shall not be begun."—(Act of Congress, approved June 7, 1894.)

MARCH 1, 1895.

Train Resistance.

Mons. Du Bousquet, a well known French railway engineer, has done much in the way of investigating the resistance of railway trains, and we give an abstract from the transactions of the Institute of Civil Engineers, which gives certain results and conclusions at which he has arrived.

The author has determined by the aid of the dynamometer the resistances per ton that the train opposes to movement on the level at different speeds. These resistances, obtained on the coupling of the tender, are only the resistances of the train, and they do not comprise the portion of the resistance of the air which is exerted in front of the engine, nor that of the engine itself.

Upon the basis of these resistances the author has obtained those for up and down gradients of 1 in 200, and gives the following tables:

Speed in miles per hour.	Resistance per train-ton in pounds.		
	On down-gradient of 1 in 200.	On the level.	On up-gradient of 1 in 200
31	-4 48	6.72	17.92
37	-2 24	8 96	20.16
43	0.00	11 20	22.40
50	2.24	13.44	24 64
55	5 82	17.02	28 22
62	9 32	20.52	31 72
68	13.44	24.64	35 84
75	17 92	29.12	40.32
81	22.40	33 60	44 80
87	28.00	39.20	50.40
93	33.60	44.80	56.00
99	39 76	50.76	61.96
106	45.92	57.12	68. 2
112	52.64	63.84	75 04
118	59.58	70.78	81.98
124	67.20	78 40	89.60

HORSE-POWER NECESSARY TO MOVE ONE TON OF A TRAIN AT DIFFERENT SPEEDS ON THE LEVEL AND ON UP AND DOWN GRADIENTS OF 1 IN 200.

Speed in miles per hour.	On down-gradient of 1 in 200.	On the level.	On up-gradient of 1 in 200.
31	negative	0.54	1.47
37	"	0 87	1.95
43	nil	1.27	2.51
50	0.29	1.73	3.15
56	0.84	2.48	4 11
62	1 52	3.33	5.19
68	2 41	4.40	6.45
75	3.48	5.56	7.84
81	4.74	7.10	9 46
87	6.37	8.82	11.57
93	8.20	10.82	13.77
99	10 25	13.13	16 07
106	12.69	15.73	18.67
112	15.34	18 62	21.88
118	18 38	21.84	25.25
124	21.56	25.48	29.00

From these tables it will be seen that under the same resistance per ton of 17.92 lbs. a train will travel at a speed of 75 miles on a down-gradient of 1 in 200, at 57 miles on the level, and at 31 miles on an up-gradient of 1 in 200; and that for the same horse-power of 3.33 per ton a train will travel at 74 miles an hour on a down-gradient of 1 in 200, 62 miles an hour on the level, and at 50 miles an hour on an up-gradient of 1 in 200. To run down a gradient of 1 in 200 with a train weighing 200 tons—exclusive of the engine—at 75 miles an hour a horse-power of 200 × 3.48 × 696 would be required, and the author also points out that to gain a few miles in speed per hour at the higher speeds a considerable increase of power is necessary. Taking a train weighing 100 tons—being the minimum weight of the through passenger trains—the power which it would be necessary for the engine to develop in order to ascend a gradient of 1 in 200 at the following speeds would be:

	H. P.
At 50 miles	315
" 62 "	519
" 75 "	784
" 93 "	1 377
" 106 "	1,857
" 124 "	2,900

These results are obtained without taking any consideration of the power necessary to drive the engine itself.

The author then takes engines in the best possible condition as far as friction and resistance to the air are concerned, and applies to them the same coefficients of resistance as for the train. Four engines are taken, one weighing 220 lbs., the second 165 lbs., the third 110 lbs., and the fourth 77 lbs. per horse-power—the weight of the engine per horse-power being a very important feature. The first question considered is at what speed these engines are capable of moving themselves. Taking the relation of the horse power to the ton:

	H. P.
1 ton of the first engine can produce	10 00
1 " second " " "	13 33
1 " third " " "	20 00
1 " fourth " " "	28.50

The power per ton necessary on an up-gradient of 1 in 200 at a speed of 124 miles an hour being 29 H. P.—see table—none of these engines can attain this speed. The first would not exceed 82 miles, the second 92 miles, the third 108 miles, and the fourth 121 miles. A train weighing 100 tons is now attached to each of these engines, and the author proceeds to determine what the weight of the engine should be in order to draw this load at different speeds on an up-gradient of 1 in 200, and what horse-power the engine would have to develope. These are determined by the following equations: The weight of the train and the weight of the engine, multiplied by the horse-power absorbed by one ton at the speed under consideration, is equal to the total horse-power; and the total horse-power multiplied by the weight of the engine in pounds per horse-power is equal to the weight of the engine in pounds. By the aid of these formulas the following table is given:

WEIGHT OF TRAIN, 98 TONS. UP-GRADIENT OF 1 IN 200.

Speed in miles per hour.	Engine weighing 220 lbs. per H. P.			Engine weighing 165 lbs. per H. P.			Engine weighing 110 lbs. per H. P.			Engine weighing 77 lbs. per H. P.		
	Weight of engine in tons.	Total weight in tons.	Total H. P.	Weight of engine in tons.	Total weight in tons.	Total H. P.	Weight of engine in tons.	Total weight in tons.	Total H. P.	Weight of engine in tons.	Total weight in tons.	Total H. P.
62	108	206	1,078	64	162	850	35	153	636	22	130	627
68	18	276	1,454	91	189	1,227	47	147	1,021	29	127	8 8
75	39	490	3,920	147	248	1,940	65	168	1,3 6	38	137	1,090
81	2,252	2,450	23,520	254	352	3,577	90	188	1,897	43	147	1 412
87	...	...	.....	656	754	8,753	132	230	2,671	69	67	1,889
93	....	...	.....	...	....	...	228	3 6	4 569	94	192	2.689
99	...	.....	...	.	...	. .	435	53	8,741	130	228	3,631
106	. ..	...				...	1,862	1,96	9',340	186	294	5,'85
1 2	...				....			... ..	.....	540	438	9 741

The Crampton engine, made in 1849, weighed 50 tons, and was capable of developing 400 H. P., thus weighing about 275 lbs. per horse-power; the engines which are constructed in France at the present day, weigh about 80 tons and develop up to 1,100 H. P., that is, 158 lbs. per horse-power.

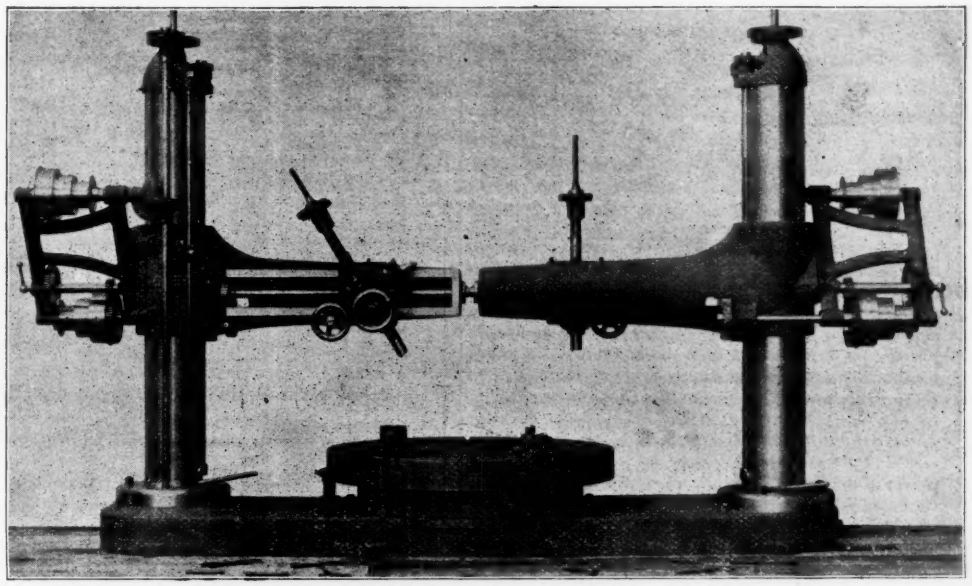
Thus the tendency has been to reduce the weight per horse-power, and has met with considerable success; and henceforth a further saving in the weight will take place in reducing the dimensions of the tender and taking water while running, and thus reducing the weight per horse-power to 143 lbs.—*The Engineer.*

A Niles Double Radial Drill.

The Niles Tool Works are making a new double radial drill for boiler work. It consists of two 5 ft. radial drills mounted on a common base. The saddles of the drills swivel, and the columns are so located that the arms just pass one another. The base plate is provided with a rotary table 5 ft. in diameter, and is located in the center of the base. The machine in all its parts is made sufficiently rigid to allow a 6 in. cutter head to be used 4 ft. from the center of either column, or two flue cutter heads, one on each spindle, for cutting out holes 4 in. in diameter. This machine was gotten up more especially for cutting out flue holes in flue sheets of stationary and locomotive boilers, and is so arranged that one operator can run it. The arms are raised and lowered by power.

The saddles have quick hand adjustment on the arms by means of a rack and pinion, and the machine is so designed that the arms will swing around a full circle. The spindle has a quick return, and all the movements of the machine are arranged so as to be within easy reach of the operator.

The circular table, and the mounting of two drills on a single sole plate, makes it particularly adapted to work requiring a large number of holes located close to one another. The careful working out of details insures a maximum efficiency from the tool. We give an engraving from a photograph of this drill showing the arrangement of its parts.



Double Radial Drill—Niles Tool Works.

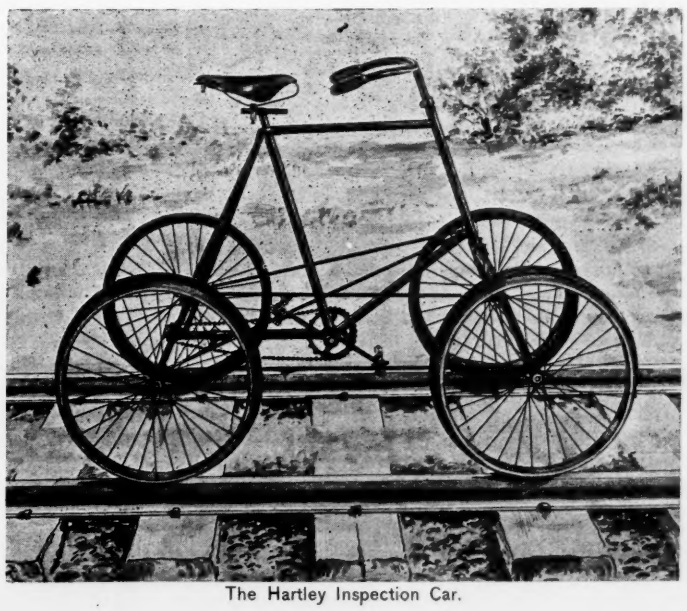
A New Railroad Inspection Car.

In the accompanying engravings is shown a very light, durable railroad inspection car, designed by Mr. C. H. Hartley, Assistant Superintendent of the Ashland Division of the Chicago & Northwestern Railroad, and Mr. C. N. Teetor, of Hagerstown, Ind., to meet the need of railroad superintendents, roadmasters, etc.

It is propelled in the same manner as an ordinary bicycle, and has four wheels, the weight being borne equally on each, so there is no need of a reduction in speed in running over frogs, switches, etc. It will run equally well in either direction, and it is claimed that a speed of 25 miles an hour is readily attained.

This car has much the appearance of an ordinary bicycle, having the same adjustable saddle and handle bar and a diamond frame. The wheels are 16 in. in diameter with steel rims and hubs, the spokes being of No. 12 gauge piano wire. The tires are faced with rubber, which serves the double purpose of affording a hold on frosty rails, and making the riding easy and noiseless, thus enabling the rider to hear approaching trains. The frame is constructed of Shelby tubing and ball bearings are used throughout. The wheel base in a running position is 4 ft. 4 in., but the forward axle being movable, and held in position by hinged side braces and clamps, can be turned back and under, thus reducing the length so as to permit of easier transportation. The weight is but 50 lbs., thus permitting easy carriage and removal from the rails. This car is manufactured and sold by the Railway Cycle Manufacturing Company, of Hagerstown, Ind.

The Hartley Inspection Car.



The Hartley Inspection Car.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.

Published Every Friday

At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

A BILL has been presented in the Massachusetts Legislature providing that hereafter the salaries and expenses of the Railroad Commissioners shall be paid by the commonwealth and not by the railroad companies. The motive for offering this bill is not very clear, and we have heard of no discussion throwing light upon it; but the principle underlying it is a sound one. If the absurd law that the railroad corporations shall support the Commissioners had not existed in New York we should have been spared the spectacle of a learned judge issuing a decision calculated to circumvent a plain constitutional provision. Such a law looks too much like compelling vassals to kiss the rod that smites them. We are not complaining on behalf of the vassals—we have not heard that any railroad company finds any fault with the tax assessed against it—but we merely call attention to the need of upholding the dignity of the State more consistently. It has been suggested that possibly a Commissioner might be unduly influenced in favor of a road, which, in giving him his, pass, added a little trimming to it, say the words "and family." Probably this consideration is not of much consequence, but it is certainly safe to say that if the State wishes to have perfectly impartial commissioners, it should put all railroads on the same footing. Although the state may have no cause to complain of biased commissioners, the large railroads may often have ground for complaining of unfair treatment at the hands of the state, as we pointed out recently in discussing the New York pass law.

The Pennsylvania Railroad Report.

The report of the Pennsylvania Railroad is always one of the most important documents of the year, and the report for 1894 is peculiarly interesting, for the loss in the earnings for the past year of this immense system is a good index of the condition of trade in the Eastern States, and the net results of the year's operations show clearly how well a strong and conservative management has weathered a very fierce storm. An abstract is given in another column. The most striking and important points to be noticed in a brief analysis of the report are the losses on the various parts of the system and the effective economy in operating expenses which has been carried out everywhere. For the lines east of Pittsburgh, including the three grand divisions, the year's results are:

	1894.	1893.
Net earnings	$18,340,538	$19,379,206
Interest on investments, Rental of equipment, etc.	5,513,195	6,036,941
Total income	$23,853,733	$25,416,147
Interest, rentals, and other fixed charges	14,383,613	15,299,712
Net income	$9,470,120	$10,116,435

The Pennsylvania holds very large amounts of securities of other companies, the interest on which adds greatly to the available income. The amount of this interest has fallen off considerably during the year, still it is the loss in net earnings which is the important fact. This very large decrease shows the extent of depression of trade, and the effects of a remarkable combination of unfortunate circumstances; the bad weather, floods, etc., during the earlier months of the year, the great bituminous coal strike, the bad state of the anthracite trade, and the general demoralization of rates. Freight rates have been falling steadily for some years, the rate per ton-mile in 1894 being 5.85 mills, or 29-100 of a mill less than in 1893.

Out of the net income, as given in the above table, the following payments were made:

Payments on account of sinking and trust funds, and for guaranteed interest	$725,101
Extraordinary renewals	1,385,271
Dividend of 5 per cent. on capital stock	6,461,645
Total to be deducted	$8,575,020

This leaves a surplus, to be transferred to credit of profit and loss, of $895,200, against $911,108, which makes a very favorable comparison, although considerably below the figure for 1892, which was $1,222,357.

For the lines west of Pittsburgh we have as the net results:

1894.	1893.
Loss $49,171	Profit $1,875,110

The details are given in another column.

In the case of that part of the system which is west of Pittsburgh we see still greater evidence of depression and bad conditions. In addition to the special conditions mentioned above as applying to the eastern lines, we find in this case as further causes of loss of earnings the crop failures and small grain movement, the low price of wheat, and the general strike of railroad hands in July.

But, after all, the most striking feature of the whole exhibit is the remarkable reduction of operating expenses over the whole system. This is clearly seen from the following figures of the earnings of all lines in any way owned or controlled by the Pennsylvania Railroad Company, and covering at present about 8,830 miles of road:

Year.	Gross Earnings.	Expenses.	Net Earnings.
1892	$138,974,521	$98,352,083	$40,622,458
1893	135,059,788	95,490,559	39,568,229
1894	122,003,000	85,142,174	36 8,0,826

This shows a falling off of $13,000,000 in gross earnings, combined with a saving in expenses of over $10,000,000, leaving a loss of about $2,500,000 in net earnings. This great cutting down of expenses for the year shows what can be done by the most careful management, with a property which is in splendid condition, without injuring its efficiency. New construction has of course been kept at its lowest point. It is to be noted that this curtailment of operating expenses cannot continue indefinitely, and this fact contains the great element of promise for revival of trade in the present year. For as soon as financial conditions look a little better, the companies must begin to make the improvements and renewals which have been kept waiting, and the large amount of money to be spent in this way will be an immense stimulus to all industries.

In the general balance sheet there are few important changes, as compared with that of the preceding year, with one exception, which relates merely to the manner of accounting. The sums which have been expended under the terms of the lease on the United Jersey Railroad & Canal Co. and the Philadelphia & Trenton, have been hitherto carried to credit of profit and loss account. During the past year the assets in the sinking fund, established for the loan made by these companies, came into possession of the Pennsylvania Railroad, and are credited against the advances made; the balance then of $4,461,875 is now charged against the general profit and loss account. One of the most commendable features of the company's method of finance, to be noted in passing, has been the establishment and disposition of the surplus trust fund against guaranteed obligations of controlled roads. The fund has reached a figure of $9,393,295, and is well invested in securities.

Classification of Fixed Signals.

We give in another column of this issue an abstract of a paper on signalling read by Mr. George Gibbs last month before the Western Railway Club, of which he is President. The paper is intended to interest and instruct a body of men who have not had occasion to acquire more than a very general knowledge of signalling, and few of whom, indeed, have had anything to do directly with signalling. It is therefore rather general than special, intended more as an exposition of principles than of the details of practice. Viewed in that way, the paper is an excellent one—very logical and systematic in its treatment of the subject. We are inclined to think, however, that Mr. Gibbs' classification in some particulars is unnecessarily minute and rather arbitrary than rational; that he has carried his love for logical systematizing further than is called for by the facts. He groups switch signals, switch interlockings, crossing interlockings and draw-bridge interlockings in his first class as "systems showing the condition of the track." Train-order and block-signals he groups in his second class as "systems for directing train movements." But we do not see the real distinction between these two classes, as far as the engineman is concerned, which is equivalent to saying as far as concerns the general subject of the principles on which signals are used, *i. e.*, are seen and acted upon. All the signals, in both of Mr. Gibbs' classes (except train-order signals and signals for isolated switches), are used in practice to keep a train off from a certain length of track, and when at safety to permit the train to proceed over a certain length of track. All of them are to direct train movements. In view of these facts, and of the importance of making railroad signaling as simple as possible in every particular, it seems desirable to avoid multiplicity of names; so much so that we should be inclined to press the argument, even if on purely theoretical lines it were necessary to stretch the logic a little.

Take, for instance, the case of a semaphore draw-bridge signal. The argument in favor of calling this a distinct kind of signal rests on the possibility that an engineman, finding such a signal at safety, may at the same time find the caboose of a preceding train immediately in front of him; an indication which conflicts with that given by the semaphore, and which suggests that this signal is not used for the purpose of "directing train movements." But one of the first rules for the use of such a signal, as of all others, is that the signal man must never place it in the clear position until he has first satisfied himself that the track over which the train is to pass is actually unobstructed; and as a corollary to this the best practice is to put such a signal to danger behind every train, even if it is to be cleared again within a few seconds for a following train. Thus we have a block signal. If there is a block system in use the outgoing end of this section may be a mile away; if there is a starting signal just beyond the bridge, the block section extends to that; and if there is neither a block system rule nor a starting signal, the end of the section is just beyond the bridge, that is, at the outgoing end of that portion of the track which the bridge signal was made to admit trains to. Thus we simplify our "system" and do violence to no essential principle.

We note this criticism of Mr. Gibbs' paper not because the point mentioned constitutes a glaring defect in his treatment of the subject, for, indeed we judge from expressions in the latter part of his paper that he recognizes the difficulties of the case himself, but because there is a tendency in many quarters to analyze signalling to death. Mr. Gibbs' paper, in general, is thoroughly sound, and signalmen will enjoy reading the complete paper as a contribution from one who takes up the subject from a standpoint somewhat different from that which usually appears in papers of this kind.

For the train order signal there is a plausible argument in favor of using a different form, thus justifying a separate classification. The signal, as Mr. Gibbs points out, does not give the right to proceed for any specific distance, the distance being varied at will by the train despatcher; but, as is also clearly recognized in the paper, there is a general sentiment in favor of making the train order signal precisely like a block signal; that is, the ordinary semaphore; so that still it is questionable whether the demand for a separate form of signal for train orders is based on anything more than pure theory, and theory which has no important basis of experience to sustain it. In the same way it has been argued that although a semaphore is admittedly the best visual signal for daylight use, an automatic block signal ought to be something different, say a disk, because an automatic signal differs from other block signals in the important particular that the engineman is permitted under certain conditions to violate the indications given to him by the automatic. An automatic signal standing at danger any length of time on account of failure of apparatus must be disregarded, in order to avoid blocking the road; while with block signals, watched by signalmen, it is practicable to enforce the rule that the danger indication shall *never* be disregarded. But the sentiment in favor of thus making automatic signals different does not seem to be strong, and those who hold it doubtless agree that other considerations may readily outweigh this point. In other words, the automatic signal, like the train order signal, may be precisely like ordinary block signals unless a different form, equally simple and safe, can be introduced and used without inconvenience or serious additional cost.

Train Resistance as It Is.

We give in this issue the substance of the results of the investigation of M. Du Bousquet, an engineer on the northern railroads of France, made to determine the variation of train resistance which accompanies a variation in speed. M. Du Bousquet is said to have obtained the results "by the use of the dynamometer" and that the results give "only the resistances of the train and they do not comprise the portion of the resistance of the air which is exerted in front of the engine, nor that of the engine itself."

Condensed to the form of a diagram, Fig. 1 shows these results. It is to be noticed that the diagram is almost too regular to be the uncorrected results, if taken from a dynamometer car, so that it is quite safe to assume that the results have been made to compare with each other by correcting them after they were obtained. Certainly the results that are above 100 miles an hour must have been obtained by a calculation of some kind, for we understand, from very good authority, that speeds of more than 90 miles an hour have not been attained on the northern railroads of France. The curve, shown on the diagram, follows very closely the law given by the following formula which we have deduced from the results given in Mr. Du Bousquet's table:

$$R = \frac{V^2}{200} + 2$$

In this formula, V is the speed in miles per hour, and R is the resistance in pounds per ton of that part of the train that is back of the tender. It will be apparent to those who are familiar with the formulas given in reference books on railroad mechanics that M. Du Bousquet's results, which it is said were determined by a dynamometer, correspond very closely therewith. Now the puzzle, for those who have kept track of the resistance tests recently made in this country, is that it has become evident that the formulas are radically wrong, while here comes an experimenter with a set of practical tests, which apparently corroborate the formulas. A prominent mechanical officer of the Pennsylvania recently said that he had lived a good many weeks in a dynamometer car, and had seen the results as actually taken at speeds up to 70 miles an hour and that he had found the formulas given in the hand books to be wrong and misleading. As he expressed it: "They are an example of a wild deduction from a false premise, or a determination of the infinite from a knowledge of the finite." In plain English this means that the law of train resistance, as given by the formulas in technical books, was determined from a few tests made over a small range at low speed; and this law has been taken to apply for speeds of 90 to 100 miles an hour. Anyway, it is a fact that an enormous number of resistance tests made in this country within recent years at high speed give results that are only a fraction of what the formulas give.

In the *Railroad Gazette*, March 18th, 1892, page 210, will be found quite a complete discussion of the discrepancies we have mentioned. The diagram there given is reproduced here in Fig. 2. The curved line corresponds to the formula:

$$R = \frac{V^2}{171} + 4$$

The small circles show the actual pull given by the locomotive pistons reduced to drawbar pull per ton of train, including head air and all other resistance, the results being calculated from indicator cards taken both in this country and in England. The results obtained from the Chicago, Burlington & Quincy and the Pennsylvania dynamometer cars corroborate the results given by the small circles and show the fallacy of the results given by the curve.

To put M. Du Bousquet's results in such shape that they can be readily understood, in the fullness of their import, the following table has been prepared to show the power that would be required to haul a 300-ton train, including the locomotive and tender, if the results represented the facts in service:

Speed in miles per hour.	Resistance in pounds per ton on level, Du Bousquet.	A. Horse-power for 300-ton train.	B. Maximum horse-power of locomotive.
62	20 5	1,460	1,190
75	29.1	2,470	1,210
87	39 2	4,040	1,157
99	50.8	5,510	1 028
112	63.8	7.630	813
124	78 4	10,410	....

Now, it is not uncommon to reach 80 and 90 miles an hour in this country with trains of 300 tons total weight and it is quite common to run even heavier trains at 70 miles an hour, but we have no boilers in locomotives that will furnish the steam for the horse power called for by these results, and the cylinders are not large enough to generate any such power, as will appear from what follows. So, if we accept M. Du Bousquet's results, a train weighing 300 tons can not be run at 70 or 80 miles an hour; but, we known that they *are* run. Therefore we must accept the results got in this country with dynamometer cars as facts until the formulas are shown to have something besides an imaginary foundation, and until M. Du Bousquet shows our errors; for, we take it, that train resistance in France cannot follow a widely different law from that which governs the movement of trains in the United States. If there is any difference at all, one might reasonably believe that it would be less in France where the wheels are larger and the roadbeds equally good, if

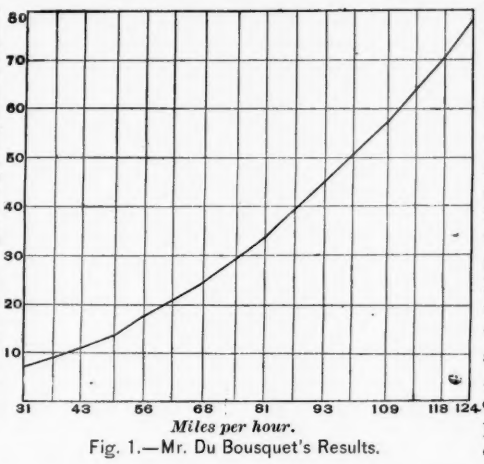


Fig. 1.—Mr. Du Bousquet's Results.

not better. Even this difference would only affect the constant factors in the law, while the rate of variation of resistance would remain practically the same.

Column *A* shows the results which an engineer would deduce from M. Du Bousquet's figures, which, it must be remembered, pertain only to the train back of the tender. To get the total resistance there must be added the resistance of the engine, the internal friction and the head air resistance. These may be taken as 10 per cent. for internal friction, and 10 pounds per square foot for head air resistance at 50 miles an hour, and 30 pounds per square foot for 100 miles an hour, without giving reason for any one to say that the allowance for these factors is too great. Column *A* has been prepared on this basis, and that it reduces the matter to an absurdity appears by comparing it with Column *B*, which gives the horse power of a 19″ × 24″ passenger locomotive with 80″ wheels, which has more cylinder power at high speed

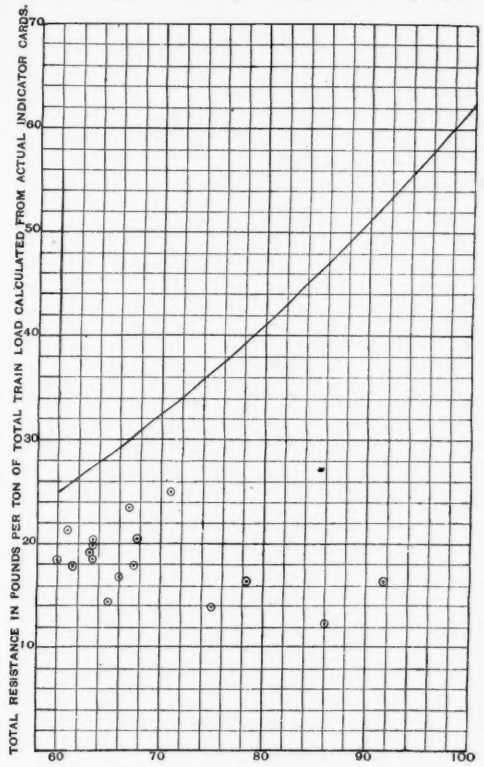


Fig. 2.– Speed in Miles per Hour.

than any other locomotive that is in use, so far as we know. This locomotive is the new class "P," of the Pennsylvania, which has an improved arrangement of the link valve gear which gives a mean effective pressure of 60 pounds per square inch at practically 70 miles an hour. It should be remembered that, no matter how heavy a locomotive is, or how big its boiler, it cannot have any more power to pull trains than the cylinders can give it. Also, the old axiom tells us that a whole can never be greater than the sum of its parts, and conversely the sum of the parts cannot be greater than the whole, and, therefore, whatever the resistances are, the sum of them can never be greater than the power, or pulling force, of the locomotive, otherwise the train would stop. Above 70 miles an hour the mean effective pressure for the class "P" has been assumed to reduce, as is the case in other locomotives, so that it would be about 35 pounds at 100 miles an hour.

A comparison of columns *A* and *B* shows the need of analysis of the records of train resistance that have already been obtained, so that, once for all, the facts may be published *pro bono publico*. A little effort by some intelligent analyst would give us a back-bone of fact about train resistance that would help in many ways, particularly in determining the fuel allowance for engineers running trains at different speeds with and without side wind; and this matter of the side wind, which does not appear to have been treated by M. Du Bousquet at all, at least not as an important factor, is of sufficient magnitude to double the resistance in open country when there is a stiff side breeze. There are numerous instances in everyday practice that exhibit clearly the absurdity of any such train resistance in this country as that given by M. Du Bousquet's results. Take, for instance, the fast mail trains ruuning west of Chicago. Some of these trains weigh 400 tons and are hauled at a speed of 53 miles an hour average, over distances of 350 to 400 miles. According to M. Du Bousquet's results the boilers and cylinders would have to average about 1150 horse power, which is of course impossible. As the trains *do* run it will be necessary for some one to show more evidence of the reliability of formulas that give these enormous resistances before they will be taken seriously.

Annual Reports.

Chicago, St. Paul, Minneapolis & Omaha.—The report of this company is for the year ending Dec. 31, 1894, and covers 1,492.23 miles operated. The results of operation are as below:

		Dec.	Dec., p. c.
Gross earnings	$7,297,619	$1 071,309	12.4
Expenses and taxes	4.946.184	897,348	15 4
Net earnings	$2.351,435	$133,961	5.3
Interest and rentals	1.521,437	1,117	
Balance profit	829,993	135,078	
Dividends	787,978	.....	
Surplus	42.022	135,078	

The passenger traffic contributed to gross earnings $1,684,409, the decrease from the preceding year being 18.71 per cent. The freight earnings were $5,215,609, the decrease having been 11.5 per cent. The passenger miles were 67,219,226 and the decrease 21.83 per cent. The average rate per passenger per mile was 2.506 cents, an increase of 4.03 per cent. The ton miles were 458,563,082, the decrease being 12.5 per cent. The rate per ton-mile was 1.137 cent, an increase of 1.16 per cent. It will be observed that the decrease in volume as well as in receipts from passengers, was a good deal more than from freight, which we suppose is due to the comparison of this year with the World's Fair year. This also will account for the increase in the rate per passenger-mile, while the increase in the rate per ton-mile is, dou btless, due to the cause now familiar, the heavy falling off in the coarse freights. This is indicated again in the report before us by the shorter haul of freight.

The report recites some of the causes of the falling off of traffic and earnings, which include excessive rainfalls in the early summer, causing interruption to traffic and considerable expense in repairs; the great strike and the re-organization of the forces; the forest fires; the crop failure ranging from partial to entire, which occurred in Iowa, Nebraska and South Dakota, and finally the general business depression. The crop failure was serious enough to reduce the gross tonnage of cereals more than 28 per cent., and that condition moreover stopped a considerable part of the lumber shipment from Wisconsin into the southwest and forced the company to seek markets, giving shorter hauls for this commodity. The forest fires destroyed over 2,000 ft. of trestle bridging, several buildings, two water tanks and 57 freight cars partly loaded with grain, flour and miscellaneous freight. The earnings, both passenger and freight, were less than in any year since 1890.

In spite of all the troubles of the year the economies, which must have been heroic, were sufficient to reduce the operating expenses in greater ratio than the gross earnings; so, while gross earnings fell off 12.4 per cent. the net earnings declined only 5.3. The ratio of expenses to earnings (excluding taxes) in 1893 was 66.3, and in 1894 it was 63.91. The heaviest decrease in operating expenses was in the item of maintenance of equipment, which was reduced 35.87 per cent. Maintenance of way and structures was reduced 15.9 per cent.; conducting transportation, 10.64; general expenses, 6.5. The cost of running locomotives per engine mile was brought down from 22.56 cents to 21.91, the decrease being 2.88 per cent.

The capital stock remains unchanged in amount—namely $34,050,127. No bonds were issued or sold during the year, and the total funded debt amounts to $24,841,127.

The Pennsylvania Railroad.—The report of the President of the Pennsylvania Railroad for the year 1894, to

be presented at the annual meeting next week, is made public. It is the custom to issue this report a good deal earlier than that of the General Manager, and to confine it mostly to financial results, leaving most of the operating statistics to follow later. The chief results of operation last year were as below, for the three grand divisions east of Pittsburgh and Erie, embracing the main line, united railroads of New Jersey, Philidalphia and Erie and branches:

		Dec.	Dec. per c.
Gross earnings	$58.7 4.285	$7.670 9 9	11 5
Expenses	40,382,747	6.632.270	14 1
Net earnings	$18,340.538	1,038.669	5.5
Interest and rentals	5 513,195	5 :,746	8.7
Total income	23,853,733	1,562,415	6.1
Fixed charges	14,383,614	913,098	6 1
Net Income	9,470,120	646,316	6 5
Deduct sinking fund, etc	725,101	694,448	21.8
Extraordinary renewals, etc.	1,385.272		
Balance available	$7,359,747	+ 48.131	....
Dividends, 5 per cent	6,161,618	+ 64,141	....
Profit and loss	895.100	16,008	....
Previous amount to this credit	26,478,152	.....	....
Total profit and loss	27,373,252	... ...	...
Net charged off for adjustment under leases, etc	4 217.620	....	....
Balance to credit profit and loss	23 155,632	3,322,519	....

The President says that the reduction of traffic consequent upon the business depression stimulated the sharpest competition that has ever taken place between the transportation interests, and required the most careful management to secure even moderate returns upon the capital. It is thought, therefore, that the results obtained must be considered satisfactory. The profit and loss account has heretofore been credited with the greater portion of the large sums expended on the properties of the United New Jersey Railroad & Canal Co., and the Philadelphia & Trenton Railroad Co. Under the lease the company is not entitled to receive stocks or bonds for these outlays. As a large amount of six per cent. bonds of the United New Jersey Company, matured in 1894, for the payment of which the Pennsylvania Railroad Co. received a like amount of securities from the United New Jersey Co., it was able to credit the value of the assets in the sinking fund established for that against these advances. The balance, $4,461,876, it was thought wise to charge against the general profit and loss account.

The funded debt of the company now amounts to $82,765,236 the increase having been a little more than a quarter of a million. The capital stock now amounts to $129,298,200, the increase having been but $27,000. No car trust certificates were issued during the year. The expenditure for construction and equipment on the main line was $1,497,436 and on leased lines $892,937, making a total of $2,390,373. Under this head are included the completion of the Broad street station, the completion of the Philadelphia & Delaware County Railroad, a local suburban line, the construction of 12 miles of the Ebensburgh & Black Lick Railroad, the purchase of additional real estate near Pittsburgh and certain additional freight cars.

From the President's report we are enabled to make up the following table of traffic movement and rates, still speaking of the lines east of Pittsburgh and Erie.

		Decrease.	Dec. %.
Tons moved	64,677,634	5,209,766	7.45
Passengers carried	38,596,160	5,559,160	12.6
Receipts per ton mile	.585 cent.	— .029 cent.	
Net profit per ton mile	.170 "	+ .003 "	
Receipts per passenger mile	1 977 "	— .022 "	
Profit per passenger mile	.395 "	020 "	

On the lines west of Pittsburgh the results were as follows:

Pennsylvania Company:

		Decrease.	Dec. %.
Earnings	$17,904,223	$3,777,014	17.4
Expenses	11,524,288	2,226,788	16 3
Net earnings	6,380,134	1,550 427	19 6
Rentals, interest, etc	7,667,610	+ 187.435	
Net loss	687,476	1.737,952	

Pittsburgh, Cincinnati, Chicago & St. Louis:

		Decrease.	Dec. %.
Earnings	$16,756 569	$1,682,490	9
Expenses	12 475,599	1,404,942	10
Net	4.280,979	272,530	6
Rentals, interest, etc	3,563 217	95,774	
Net profit	697,761	176. 75	
Net gain on lines directly operated	10,285	1,914,727	

The loss to the Pennsylvania on other lines west of Pittsburgh, which are operated through their own organizations, amounted to $59,457, and deducting the profit shown above, the net loss on all lines west of Pittsburgh was $49,171. On the western lines there was expended during the year for construction, equipment and real estate the sum of $631,770.

The traffic movement on these lines was as below:

		Decrease.
Tons moved	43,088 278	7',139
Passengers moved	16,634,303	2,266,755

On all lines of the system the gross earnings amounted to $122,003,000, and the net to $36,860,826. Over 129½ million tons of freight were moved, and over 77,000,000 passengers carried.

Concerning the Delaware River bridge the President says the right of way has practically been secured and construction is rapidly progressing, and it is hoped that it will be completed during the year. The work of elevating track in Elizabeth and Philadelphia has been carried on, but the management believes that it is wise for the present to suspend further large expenditures of this character until definite legislation is had to prevent the increase of highway crossings at grade. It does not seem equitable that outlays of this character should be made by the company when their object is defeated by the continued opening of new highways and by the privilege granted to electric lines to use them at grade.

The Railroad Bond Market for February.

In February the new government bonds absorbed much attention and exerted a controlling influence over other issues. As stated in our last report the new bonds were sold at 104.49 on a 3¾ per cent. basis. The bonds were offered to subscribers at 112¼ here with the May coupon attached and at 113½ in London. This with exchange figured, would be equal to 110.776 here. The rate was ex the May interest, making the price in the two centers about equal. At the time the bonds were offered they were bid 119 to 119½ in the open market. The object of the syndicate in selling some 6 to 7 per cent. below the market was that it might secure the co-operation of financially powerful purchases in its effort to build up the Treasury gold reserve, and incidentally to stop gold hoarding and gold exports. To this end it sold the bonds to applicants who had gold to exchange therefor, not withdrawn from the Sub-Treasury for the purpose, and for the most part to foreign houses, who agreed as a consideration, in addition to the price paid, to do all in their power to prevent gold exports.

Immediately after the sale on allotment the bonds were traded in at 119 to 119½. This afforded a profit of some 6¾ to 7¼ per cent., which some holders were not slow to take. The price reacted under realization to 118, and then returned to 119 to 119½, where it is at this writing.

Considerable curiosity was expressed as to the ability of the syndicate to make good its promises to keep exchange below the specie point. The syndicate was put to the test during the middle of the last week in the month, when exchange went to 4.88 to 4.90, and gold exports seemed imminent. At just the right time it offered 60 day bills at 4.87½, which is just sufficiently below the specie point to make them attractive to remitters, and rendered gold exports unnecessary. Later the syndicate took advantage of the fact that large cash payments were to be made on account of the bond purchases, to run up the rate on call money from one per cent, where it has ruled for 18 months with only slight variations, to 5 to 6 per cent. The idea was to make the rates so attractive to foreign capital that it would not be called for. The natural result of this sharp advance was a flood of money which caused a reaction.

The different developments of the new loan were reflected in the municipal and railroad bond markets. No better illustration of the uncertainty and subsequent recovery can be cited than the reception accorded the $3,265,000 three per cent. gold bonds offered by the city of New York. Bids opened early in February were so unsatisfactory that the comptroller would not entertain them. Bids submitted in the last week resulted in tenders for $12,500,000 from par to 103¼. The course of old governments during this period of uncertainty and final renewal of confidence may be cited. The table which follows shows that the recovery has been practically complete.

	High.	Low.	Last Sale.	Sales.
U. S. 4's coupons	113	110¼	112⅞	$125,000
U. S. 4's, registered	113	110	113	253,000
U. S. 5's coupon	116¼	115	116	823,000
U. S. 5's, registered	116½	114½	116½	119,000
U. S. 4's, new loan, when issued	119⅜	118¼	119⅜	125,000

The volume of transactions of all issues was greatly under that of January. The heavy sales were recorded in the speculative classes. The only group which did not more than recover the early depression was that of the receivership railroads. The others close the month with net advances. The following table supplies the details:

Receivership group declined	1.02
Granger group advanced	.67
Trunk lines group advanced	.33
Southwestern group advanced	.56
Transcontinental group advanced	.39
Coalers group advanced	.08
Southern group advanced	.21
Miscellaneous group advanced	.78
Total list advanced	.15

The unfavorable outlook for railroad rehabilitation caused heavy liquidation in the issue of a number of the receivership roads. There were also specific developments along the same lines. While the story of a new Atchison plan, imposing an assessment of 4 per cent. on the general mortgage 4's was not reflected by a decline in those bonds, it created much hard feeling among owners who felt that the first lien ought not to be called upon to bear any burdens of the re-organization. Erie bonds lost 7⅝ points on heavy local and European sales based on the practical certainty that they will be called upon for a heavy assessment in a modification of the reorganization. The company's financial condition has not improved since the first of the year, and while it is keeping up interest on securities, heretofore in default, it is compelled to draw upon funds that should meet labor and supply bills. An early issue of receivers' certificates is expected as a result.

As the time for more definite action regarding Northern Pacific reorganization approaches the junior securities grow weaker. During February, holders, especially those resident in Europe, were heavy sellers. Their action was prompted largely by unfavorable developments in American railroad properties during the month, notably among which might be mentioned in addition to Erie and Atchison, already cited, the Norfolk & Western receivership, and the passing of the Canadian Pacific dividend on the ordinary shares.

Reading securities have been strong despite the unfavorable coal trade developments. The advance in the 4's is doubtless in the idea that they control the situation, while the appreciation in the junior securities was in some measure due to purchase by interests who have sold their stock to secure funds for that purpose. The idea being that the incomes stand considerable chance under a reorganization while that of the stock is practically nil.

The various Norfolk & Western issues declined sharply upon the announcement of the receivership and then reacted to former prices, indicating that the condition of the company had been discounted before the protection of the court was sought.

In the Granger and Trunk Line groups, as a rule, the low prices were recorded in the middle of the month. The continued selling of investment holdings of Northwest and St. Paul stocks naturally caused some timid holders of the bonds of those properties to sell out. The net average change in the Grangers is practically nil, while in the Trunk lines it was ⅛ of 1 per cent. The stability of the bonds of these two classes was in marked contrast to the weakness in the stocks.

The Southwestern group was irregular and not as active as usual. Transactions were largely speculative, and the mid-month reactions were due in a measure to realizing sales. The feature of the group was St. Louis Southwestern 1sts and 2nds, which advanced 5 and 4¼ points respectively. A decided improvement in earnings and the execution of a large investment order in the 1sts was responsible for this appreciation in both classes. The 2nds were bought largely on speculation. The Missouri, Kansas & Texas 4's and 2nds, and Texas & Pacific 1sts and 2nds were in somewhat less demand than usual, although their prices were very firm. The Missouri, Kansas & Texas issues sold to the extent of over $850,000 par value. Wabash 2nds lost on poorer earnings.

The coal issues are so far removed from immediate conditions that their prices but feebly reflect the outlook for the coal trade. Susquehanna & Western 5's was the only issue which lost ground. This movement was due largely to disquieting rumors regarding the company's financial conditions, which were followed by one or two attempts to sell considerable long stock.

In the Southern group Southern Railway 5's are practically unchanged as compared with the previous month's prices. Transactions were quite heavy, aggregating to over $670,000 par value. Chesapeake & Ohio issues, considering their activity, which was quite largely speculative, were fairly firm.

The miscellaneous group showed a fair all-around improvement. A table, showing the amounts of various of the most active bonds sold, follows:

Atchison 4's	$627,000
Ches. & Ohio gen. 4½'s	495,000
Mo., Kansas & Texas 4's	555,000
Mo., Kansas & Texas 2nds	304,000
Mo., Kan. & Eastern 1sts	322,000
Northern Pacific con. 5's	376,000
Rock Island ext. 5's	384,000
St. Louis Southwestern 1sts	480,000
St. Louis Southwestern 2nds	874,000
San Antonio & Aransas Pass. 4's	233 000
Southern Railway 5's	672,000
Texas & Pacific 2nds	377,000
West Shore gtd. 4's	295.000

Mr. Luis Jackson, Industrial Commissioner of the Chicago, Milwaukee & St. Paul, has sent to the *Ontonagon Miner* a two-column protest against the proposition now before the Legislature of Michigan, to reduce railroad fares in the upper peninsula of Michigan to the level of those prescribed by law in the lower peninsula. This letter is worthy of note on two accounts; first, because so many railroad managers think it beneath their dignity or not worth while to write (or allow their subordinates to write) to the newspapers on such subjects as this, and, second, because the newspaper referred to prints this letter in large and clear type, leaded, on the editorial page. There seems to be an attempt at fair and reasonable discussion on both sides. Mr. Jackson, like most railroad officers when they are arguing against reduction of rates, proves too much, in some cases; that is, he presents certain strong arguments in favor of the railroads which cannot be forced between the teeth of the average legislator—to say nothing of making them sufficiently palatable to induce him to swallow them—without considerable dilution. On the other hand, this letter presents some telling facts which ought to lead the most hard-headed granger to reflect a moment. The line to Ontonagon from Channing could not pay operating expenses for a moment but for the traffic it gets from other parts of the same company's lines. In other words, if the line into Ontonagon had been built by an independent company, instead of by a corporation having large resources in other territory, it could not be made to pay. The company could not afford to run passenger trains on this line except in connection with a long line in Wisconsin. But *with* this advantage a sleeping car is run through to Ontonagon every day, the year round, although it generally takes only two or three passengers to or from that place. The company could not afford to give this accommodation but for the fact that it operates its own sleeping cars. In closing, Mr. Jackson reminds the advocates of the proposed law (who, it appears, had presented an argument in the columns of the *Miner*) that business men, who are the most frequent travelers and freight shippers, do not complain about railroad rates. In spite of this fact, citizens whose relations to the railroads are remote, as compared with those sustained by business men, are determined to bring up the question of rates and their legislative control every year; and as the C. M. & St. P. runs through eight states the company has unnecessary trouble on its hands in eight places every year.

The Interstate Commerce Commission has issued in pamphlet form a report, written by Commissioner Veazey, on the complaint of Mr. E. W. Emerson, a Spirit-

ualist "minister," that the Chicago, Rock Island & Pacific and the Chicago & Northwestern had unjustly discriminated against him in not giving him a reduced rate ticket, such as is given to ministers of religion generally. Mr. Emerson lost his case because it appeared that he had not really made application for the tickets in any effective form; and, such being the case, we are at a loss to know why the commissioners took the pains to issue a pamphlet of four leaves 6 in. × 10 in. to apprise the world of the fact. The only question in the matter of any interest to the public is whether spiritualism is a religion. On this the world would be glad to have a judicially expressed opinion from Mr. Veazey and his colleagues, but he does not give us a single ray of light on the subject, and we are left in darkness as profound as that which prevailed at the séance where Artemus Ward tried to collect, through the medium of the medium, a debt of $6.50 which was owing to him by his lately deceased business partner. The railroads in this Chicago case "did not dispute the claim of the complainant that spiritualism is a religion," and both companies have in the past issued half-rate permits to ministers of the "Spiritualist faith."

The elaborate statistical report of the Russian Railroads for the year 1892 has recently been published. With regard to the freight movement, which is very fully reported, what seems most remarkable is its stationary character. For five years the quantity moved had been, in tons of 2,000 lbs.:

1888	1889.	1890.	1891.	1892.
34,704,000	34,776,000	35,416,000	35,236,000	34,956,000

There was little change in the mileage worked during this period. The bad harvest of 1891 and the consequent famine decreased traffic, but not to the extent that might have been expected. The grain that otherwise would have been exported was shipped to the districts where there was a scarcity, which do not ship much grain even when crops are good. From 1888 to 1890 the increase was little more than 2 per cent., and if it had continued the growth would still have been small, as we look upon such things. If we go further back, it is true, a great gain is seen, the freight movement for the five years previous to 1888 having been, in tons:

1883.	1884.	1885.	1886.	1887.
26,388,000	26,199,000	27,180,000	26 601,000	30,618,000

This shows little change from 1883 to 1886, but thence to 1888 an increase of more than 30 per cent. Of the total freight shipped, grain and flour made up 17.9 per cent. in 1892, against 21.9 in 1891 and 20.7 per cent. in 1890. The quantities of grain and flour carried were 73,342,200 tons in 1890, 7,720,200 in 1891 and 6,242,400 in 1892. The shipments of coal have increased materially, but are still very small for a great country like Russia, having been in tons:

1890.	1891.	1892.
4,804,200	5,214,600	5,754,600

As interesting to us as anything, perhaps, is the movement of petroleum and its products, which has been in tons:

1890.	1891.	1892.
2,091,600	2,197,800	2,323,800

The last year's movement is about equivalent to 700,000,000 gallons of crude petroleum. The effect of the dearth is shown especially in the destination of the grain shipments. Shipments to Baltic ports, Black Sea ports, and ports on the Sea of Azof (the later having its outlet on the northeastern coast of the Black Sea), those to Prussian and Austrian border stations and those to interior consuming points are given separately. Now in 1890 547,200 tons of wheat were carried to the home consuming markets, 937,800 in 1891 and 1,153,800 tons in 1892; and of rye, the other chief bread grain, 331,200 tons went to these home markets in 1890, 752,400 in 1891 and 824,400 in 1892. The wheat shipments to Black sea ports (chiefly to Odessa) fell from 51,360,000 bushels in 1890 and 44,460,000 in 1892 to 17,640,000 in 1892. The destination of shipments shows that of the 2,323,800 tons of petroleum carried in 1892 only 102,600 tons went to seaports on border stations whence it could be exported.

The New York State Railroad Commissioners have made a report of their investigation of the numerous accidents on electric street railroads in Brooklyn, but we find in it nothing new except the recommendation that the method of payment of motormen and conductors "should be such as not to tend to cause employees to attempt to make up time by running at an excessive rate of speed." The Board believes that the fenders now in use in Brooklyn are of little or no practical use. The speed of electric cars in suburban districts should be not over 12 miles an hour; for more thickly populated districts the Commissioners make no recommendation, holding that this must necessarily be left to the local authorities. The other recommendations in this report are substantially the same as those presented in the annual report of the Commissioners more than a year ago. These recommendations, as we pointed out in our article of Jan. 18, cover the case very thoroughly.

Mayor Scheiren of Brooklyn has presented to the Board of Alderman of that city an ordinance based on the report of the State Railroad Commissioners. Its principal provisions are:

The speed of trolley cars shall be limited as follows:
Anywhere within a radius of one mile from the Brooklyn Bridge terminus or from the foot of Broadway, Brooklyn, E.D., the rate shall not exceed six miles an hour. In any other part of the first twenty-eight wards of Brooklyn, the rate shall not exceed eight miles an hour. In the Twenty-ninth, Thirtieth, Thirty-first and Thirty-second wards of Brooklyn the rate shall not exceed ten miles an hour. All cars must stop with the front platform at the near crossing. Outside of the radii above defined, cars shall not stop inside of any block which does not exceed 300 feet in length. In blocks exceeding 300 feet in length and outside of the radii above defined, there shall be a stopping place in the middle of the block, indicated by a sign bearing the words, "Trolley station." All cars shall come to a full stop before crossing any intersecting railroad. No one but motormen or conductors shall be allowed on the front platform of the cars, but such platform may be used for the exit of passengers at the corner stoppages. The rear platform gate on the track side shall be always kept closed.

This and a resolution providing for the appointment of inspectors by the Mayor was referred to the Railroad Committee. A special commission appointed some time ago by the Mayor to investigate this same subject, made a report of the same general tenor as that of the State Commissioners, but in addition it was recommended that the companies provide waiting-rooms at their depots for the men, where tea and coffee might be obtained at reasonable cost, the Commissioners believing that accidents had occurred in consequence of the use of intoxicants by employees. It was also recomended that the law requiring wagons to keep out of the way of street cars be more rigidly enforced.

A railroad employee in Detroit (according to *The Headlight*, the monthly paper published by the Railroad Secretary of the Young Men's Christian Association in that city) recently received a letter from a superior containing words of commendation, which was the first communication of that nature that he had ever received from an officer of the road, although he had been in the company's service 24 years. As the state of things shown by this incident is not different in its essential feature from similar conditions observable in all kinds of business, we shall not trouble the reader to comment upon it at this time, further than to say that the reflections on the subject by the editor of *The Headlight* are sensible and in good taste. But our attention is drawn to the item more particularly because at about the same time we noticed the statement in a Buffalo paper that Mr. S. G. DeCoursey, Receiver of the Western New York & Pennsylvania, had not only made formal expression of his gratification at the energetic and effective way in which the employees of that road dealt with the great snowstorm of Feb. 8–11, but took occasion to add to his letter the hope that "no employee had suffered by reason of exposure." General Superintendent Bell circulated the substance of the letter along the road, congratulating the subordinates on the small number of accidents to engines and cars and the entire absence of injury to persons. If any reader regards this incident as only a straw, and feels like asking why we take the space to mention it, we answer that such straws are not quite so common as they ought to be; people are likely to forget, from the absence of straws, which way the wind is blowing.

In the Grand Central Station at New York City there are now special attendants wearing red caps, to assist women and children off the cars and help carry babies and hand baggage to the street exit, which is 500 ft. or 600 ft. from the place where the rear cars of long trains stop. Mr. Daniels has appointed a dozen men to these places (they are not porters, he says), and among them are a Frenchman, a German, a Spaniard and speakers of other foreign tongues. It is not very clear why these attendants should be separated, as a class, from the ordinary porters at the station, who attend both outward and inward passengers.

NEW PUBLICATIONS.

Locomotive Testing at Purdue University. By James H. Smart, President, and Wm. F. M. Goss, Director of Engineering Laboratory, Purdue University, Lafayette, Ind. Published in pamphlet form, 6 × 9 in., 12 pages and five full-page plates.

This pamphlet has been published to give a concise statement concerning the facilities for testing locomotives at Purdue University. The principles underlying the plan of mounting the engine are briefly discussed first and then follows a short history of the work done on the locomotive "Schenectady" in the original plant, up to the time of its destruction by fire Jan. 23, 1894. A description of the new plant, illustrated by five plates, is then given. This plant occupies an especially arranged building and has many improvements not possessed by the original one. The carrying wheel foundation, as now constructed, can accommodate any standard 8, 10 or 12-wheel engine with a driving-wheel base of not more than 18 ft. 6 in. The traction dynamometer now consists of the weighing head of an Emery testing machine, with the hydraulic support. Its capacity is 30,000 lbs. The draw bar pull is registered very accurately, which is especially necessary, as the writer points out, when the speed is high and the pull small.

A short sketch of the building and minor details closes the work. A track has been laid from the locomotive laboratory, and engines may be brought under their own steam directly into position on the carrying wheels.

This little book fulfills exactly the purpose for which it was intended, that is, it answers queries concerning locomotive testing facilities at Purdue. The presswork is good, but the lettering on the cuts is small and indistinct, which spoils the otherwise good appearance of the illustrations.

The Memphis Bridge.—A report to George H. Nettleton, President of the Kansas City & Memphis Railway and Bridge Co. By George S. Morison, Chief Engineer of the Memphis Bridge. New York: John Wiley & Sons, 1894. Price $10.

We have published so much in the past concerning this great engineering work that it is hardly necessary now, in reviewing Mr. Morison's report, to to go into particulars either of history, design or methods of construction, all of which are here treated at length, and beautifully illustrated with engravings directly from photographs and with lithographs from line drawings. As is usual in Mr. Morison's reports, very complete and minute information is given in appendices, where will be found in detail the acts, ordinances, contracts and preliminary reports, as well as complete tables of tests of material, of borings, of progress in sinking caissons, etc. The report is published in the form which Mr. Morison has always chosen, namely, an oblong shape 13½ × 22 in., which, while inconvenient for handling and filing, is the best form for illustrations and for the elaborate tables which accompany these reports.

Aside from the fact that the Memphis bridge has the longest trussed span in America and the longest but two in the world, and aside from the great depth and difficulty of the foundation, the mere size of the undertaking makes it important. The bridge proper is 2,888 ft. long of this the continuous superstructure is 2,258 ft., the deck span at the west end 339 ft., and the metallic viaduct west of that 2,291 ft.; and still further west is a timber trestle 3,112 ft. long. The total cost of the bridge was in round numbers $3,000,000; or only $1,856 short of $3,000,000. The expenditure for construction made under the direction of the chief engineer amounted to $2,542,365. The other half million was for real estate, interest and minor expenses. The substructure and superstructure each cost nearly a million dollars; the substructure $968,988, and the superstructure $979,991. The approaches cost $290,000, and the charge under the item of engineering is $128,523.

In the substructure there are four large piers which cost in the aggregate $879,572, the average per cubic foot being 84.8 cents, which does not take into account concrete below the cutting edge, or clay left in chambers above the cutting edge of the several caissons. Two of these piers, namely, Pier II. and Pier III., reached depths below high water of 130.82 ft. and 128.11 ft., and these cost $309,617 and $309,352 each, or per cubic ft., 80.9 and 97.7 cents. It will be remembered that the unusual, and we believe original, expedient, was resorted to in sinking these piers of covering the bottom of the river with mattresses 240 × 400 ft. each, on which the caissons were landed, and which were cut through as the work sank and which afterwards formed a floor for the reception of riprap. Two of these mattresses were used at Pier III. and three at Pier II., overlapping each other and making the total area covered by the mattresses about 186,200 sq. ft. for Pier II. and 108,800 for Pier III. These mattresses cost in one case $26,524 and in the other $17,132. The foundations of the piers were put in by the bridge company by a force working directly under the Resident Engineer, Mr. Alfred Noble. The masonry was built by contract.

The story of the sinking of the foundations is interesting and instructive and given at considerable length in the report. The most interesting single incident, and the most critical one, occurred in the sinking of the caisson for Pier III. This was brought into position on Nov. 28. The river had begun to rise, and by Nov. 25 it had reached a 23-ft. stage. The current made an angle of about 10 deg. with the axis of the pier, and tended to move the caisson toward the west. On Nov. 19 the caisson was 20 ft. out of place, but by the aid of two tugs and five lines to Pier II. it was brought back into position 5 ft. east of where it belonged. Four days later all the lines leading east, and one leading northeast, parted, and the caisson was carried 50 ft. west of its true position. Five coils of wire rope were brought down on a passenger train from St. Louis, 350 miles, in one night, and additional anchors were put on until the caisson was held by 18 wire ropes. These were anchored by crib anchors, and by these lines the caisson was brought into position again and landed in 44 ft. of water. The Chief Engineer says that if the water had been 5 ft. deeper it would have been impossible to land the caisson, and its safety he ascribes to two things; first, the mat which prevented the deepening of the bottom, and second, the strength of the anchorages. The credit for the former is due to the Chief Engineer, for the latter to the Resident Engineer.

The continuous superstructure consists of an eastern anchorage arm 225 ft. and 10 in., one channel span 790 ft. and 5 in., and two spans, each 621 ft. and ½ in. The trusses are placed 30 ft. apart and the greatest depth of truss is 77 ft. $7\frac{13}{16}$ in. The depth of the suspended span trusses is 56 ft. 5¼ in. The bottom chord of the superstructure is made stiff throughout its entire length for reasons given in detail in the report. The only portions of the top chord made in eye-bars are in the anchorage, in the cantilever arms and in the end half-panels of the central span. The stiff chord adds to the lateral stiffness of the bridge and somewhat to its vertical stiffness, and in spite of its cantilever construction the bridge is very free from vibration. The transverse bracing is rigid throughout, made in the form of lattice frames, stiffening not merely the center of each post but intermediate points above; the Chief Engineer believing that the two trusses of a bridge should be made as nearly as possible a single truss. This principle was carried through the whole superstructure; and in the end posts of the intermediate and central spans and the posts of the cantilevers, which carry the weight of the intermediate spans, the stiffening was carried further by extending portal plates down the sides of each separate post, uniting the sides with a stiff portal. In case of the large vertical posts over the piers these portal frames were united with the floor

beams below, so that the two posts formed from top to bottom practically a single member. The Chief Engineer recommends that in the study of the details of the work, which are carefully described, one should bear in mind the special reasons existing for securing unusual stiffness.

The entire superstructure is of steel. The rivet holes were drilled in all principal members and punched and reamed in the lighter members. The tension members were proportioned for 20,000 lbs. per sq. in. dead load and 10,000 lbs. live load. There were a good many novel details in the design of the bridge itself and in the methods and appliances for construction, some of which we have described heretofore and all of which may be studied in this elaborate report.

TRADE CATALOGUES.

Pumps for Every Service. The Gould Manufacturing Co., Seneca Falls, N. Y. Thirty-fifth edition, 1895.

This elaborately gotten up catalogue contains, besides pumps for every service, fire engines, rams, etc., etc., tables containing much information of value to engineers. The friction of water in pipes, relations between pressure and head, rules for belt transmission and shafting, tables for equalizing pipes, horse power required to raise water to given heights, and much other information is so presented as to be of considerable value to hydraulic engineers for purposes of reference.

Signaling. A Catalogue of Devices and Their Parts. The Union Switch and Signal Co., Swissvale, Pa. 1894.

It is only 20 years since the interlocking of switches and signals was introduced in the United States, and at that time, we venture to say, there were not a hundred railroad men who really knew what interlocking accomplished, let alone *how* it was accomplished. Ten years ago there were in operation in the United States 227 interlocking plants, aggregating 2,659 levers, Now, we are told by the publishers of this catalogue, that more than 900 Saxby & Farmer machines have been built in this country by the Union Switch & Signal Co., containing over 16,000 levers. A comparison of these figures gives some notion of the growth in size of the interlocking plants, as well as in their absolute number. In 1885 the machines averaged 11.7 levers each. At the end of 1894 the machines installed up to that time by the Union Switch & Signal Co. averaged 17.8 levers each. These, of course, included all the early small plants, for up to 1885 hardly any interlocking had been done in the United States except by the Union company or its parent, the Toucey & Buchanan Interlocking Switch & Signal Co.

We are told further in the preface to this catalogue that one railroad system has in service about 200 machines with 4,100 levers, or 20.5 to each machine. But all this does not include the 46 electro-pneumatic machines with 1,600 levers, 34.8 to the machine. Of course, we are speaking now of the work of one company.

All of this indicates that the *educational* work of the signal companies, which was tedious and expensive, has sunk to a place of much less importance than it held even so late as five years ago; so the company, in issuing this new catalogue, confines it to an illustrated list and description of the articles made by the Union Switch & Signal Co. But even so restricted, the catalogue is a book of 352 pages, 12 in. × 8¾ in., very compactly and systematically arranged. This indicates how the art of signaling (block signaling is included in the catalogue) has grown and been specialized. In fact, it has come to be a peculiar and important field for the application of civil, mechanical and electrical engineering.

The scheme and workmanship of this catalogue are excellent. On a left-hand page is a cut of a machine and on the facing page is the description. Then, on the following pages are the details of this machine, numbered, and facing the list of numbered parts, with any necessary special description. In order to preserve this exact and systematic arrangement an extra page must be inserted occasionally, as the lists run over a page. To fill these pages full page views are given of important installations or structures, with a few words of description. The arrangement, which has been followed systematically, groups related matters. Finally, there is a very full alphabetical index.

It would take too much of our space to say in any detail what the catalogue covers. In brief, it includes interlocking, mechanical and electro-pneumatic; automatic block signaling, electro-pneumatic, and disk; the Union lock and block system; and frogs, switches and crossings.

Creosoting Piles and Timber, and *Valentine's Subway Electrical Conduit.* Eppinger & Russell Co., Broad street, New York, 1894.

This catalogue, issued by the largest wood-preserving works in the world, treats in detail of the dead oil of coal tar process, as applied to the preservation of ties, piles, etc. Numerous cuts showing the results of this method of preserving are given, together with a description of the plant. Tables of results with creosoted ties upon the railroads of Great Britain and Ireland show the life of ties so treated.

The Valentine subway electrical conduit, of creosoted timber, also made by this company, is described, and recommends itself by its cheapness and simplicity to all interested in underground wiring.

Solid Vestibule Trains is the title of a handsome little pamphlet of half a dozen pages issued by the Chicago, Milwaukee & St. Paul. The text gives "a woman's opinion" of the compartment sleeping cars and other elegant appliances of the fast trains of this road, but the whole story is told by the pictures. These are handsome and finely executed. They are no better than several other roads have issued, but it is plain that they are new, for the vestibules extend the whole width of the cars and the women all wear very big sleeves. As most of our readers will remember, the C. M. & St. P. runs its own sleepers, which are lighted by electricity. The electric lights are a prominent feature of the interior views.

TECHNICAL.

Manufacturing and Business.

The following companies have been recently incorporated in Illinois to manufacture or deal in railroad supplies and equipment: East St. Louis Rolling Stock Co., at East St. Louis; capital stock, $50,000; incorporators, Henry D. Sexton, Stephen D. Sexton and N. C. McLean Maxwood Brake-Shoe Co., of Chicago; capital stock, $25,000; incorporators, Frank P. Stone, John C. McLachlan, and C. R. La Mena. The Runyon Bridge Construction Co., of Kansas City; capital stock, $20,000; incorporators, Walter Rider, L. R. Cherry, C. S. Lewis and others. McDonald Automatic Railway Gate Co., of Chicago; capital stock, $200,000; incorporators, A. J. McDonald, J. F. Waters and J. L. Rodgers.

The Baugh Steam Forge Department of the Michigan-Peninsular Car Works, at Detroit, which has been employing a limited number of men for many months, has this week started work at full capacity, giving employment to nearly 500 men.

Iron and Steel.

The puddling department of the plant of the Republic Iron Works, at Pittsburgh, Pa., has resumed operations, after an idleness of 18 months.

The puddling department of the Elmira, N. Y., Steel & Iron Mills resumed operations Feb. 19, after a forced shut down of several weeks. Six puddling furnaces were fired.

The Philadelphia Roll & Machine Works, for which the machinery of the Bush Hill Iron Works was purchased recently, will build a machine shop 50 ft. × 100 ft, and a foundry 50 ft. × 200 ft., both to be supplied with electric cranes and with new machine tools.

The American Steel Casting Co., Thurlow, Pa., has decided to start up its plant at Sharon, Pa., by March 10. It has been idle for more than a year.

The Brazil Foundry & Machine Shops, Brazil, Ind., have resumed work on full time and with a full force of men. For the past two years this plant has been working on half-time with half a force.

The E. P. Allis Company, of Milwaukee, has shipped to the Quincy Mining Company, of Hancock, Mich., a steel shaft of unusual size. The shaft with its three hubs, and two cranks weighs 60 tons, and is 32 ft. long. It will carry a steel hoisting drum that is 26 ft. in diameter and has a 15-ft. face. On each end of this great drum will be wound 14,000 ft. of steel cable, 1½ in. in diameter, making 28,000 ft. in all.

New Stations and Shops.

The Youngstown Bridge Company is now doing bridge work for the Cincinnati, Hamilton & Dayton and the Texas & Pacific railroads. It has a reasonable amount of work under contract in its shops for future delivery, but is prepared to make quick delivery or all orders.

The stockholders of the St. Joseph Union station have authorized the directors to build a station to replace the building which was burned some weeks ago. Plans for the new structure have already been prepared by E. J. Eckels, a local architect. It will cost about $150,000. Mr. W. C. Brown, of the Chicago, Burlington & Quincy, is President of the Union Station Company.

The Berlin Iron Bridge Company is building the iron roof for a new machine shop for the Hudson River Power & Paper Co., of Mechanicsville, N. Y., and also for the new plant of the Poughkeepsie Electric Light & Power Co. The latter work includes an engine and dynamo room 61 ft. × 170 ft. and boiler room 70 ft. × 60 ft., both buildings being covered with corrugated iron roofing of the Berlin Bridge Company.

Master Car Builder's Circulars.

Mr. John W. Cloud, Secretary of the M. C. B. Association, has issued a circular under date of March 1, giving prices of M. C. B. freight couplers and coupler parts. The list includes 18 couplers, the prices for coupler complete ranging from $9.50 for the Buckeye to $12.50 for the Chicago, Gould, Standard, Trojan and Van Dorston.

A committee of the same Association, Mr. E. D. Bronner, Chairman, sends out a circular of inquiry concerning air and hand-brake apparatus. Twenty-four specific questions are asked, covering the ground very thoroughly.

Cost of Armor Plate.

The first armor made for the Government by the Bethlehem Company, ranged in price from $490 to $600 a ton. The average price was $538.70. This was in 1887. When nickel steel was adopted, the Government furnished the nickel and allowed $11.20 a ton for the additional cost of manufacture. Orders for nickel steel armor were given, at prices ranging from $500 to $575 a ton, while two lots, presenting especial difficulties in manufacture, cost $600 and $725 a ton.

When Harveyized armor was first made, a royalty of $11.50 a ton was paid to the Harvey Steel Company, and $50.40 a ton to the armor makers for plates 8 in. thick and upwards, $78.46 for plates from 5 to 8 ins. and $100.80 for those under 5 in. One item which increases the cost of our armor is the 3.25 per cent. of nickel which it contains as against 2 to 2.5 per cent. in foreign armor. French armor costs $444 to $463 for nickel steel, with a price of $341.46 for that made for foreign trade. The corresponding English price is $358. For Harveyized steel, the English domestic price is $501 to $526, the foreign price, $307 to $341. The custom of selling at lower prices to foreign dealers seems to be general. It has caused the introduction of a clause in the naval bill just passed by Congress requiring makers to furnish armor to the Government at a price no higher than that charged foreign buyers.

Leonard Hydrostatic Buffer.

One hundred or more cars belonging to the Wagner Palace Car Company and to the New York Central and Hudson River Railroad Company are now equipped with the hydrostatic buffer, and it is being applied to other cars It is substantially the same as was applied to the Empire State Express in 1893, except that a few changes have been made in the details. The apparatus requires to be pumped up, and the pressure re-stored at inspection points of the road, but with this exception it is automatic in every respect.

Electric Motors on Steam Railroads.

We noted last week the plans of the Pennsylvania and the New York, New Haven & Hartford for running electric motors on short passenger lines. This week a similar announcement is made concerning the People's Railway, a short independent road running out from Pottsville, Pa. The last time-table of this road in the *Official Guide*, shows seven passenger trains each way daily, only part of them, however, running through to the terminus, 15 miles from Pottsville. The electric motors, according to the announcement, are to be run only between Pottsville and Minersville, four miles. It appears that the electric cars are to be run by the Schuylkill Electric Railway Co., which operates street railroads in Pottsville. The motor cars will each have two 50 H. P. motors. The Schuylkill Electric Railway is to put up a new power station with four 500 H. P. Walker generators, driven by Corliss engines.

THE SCRAP HEAP.

Notes.

On the Pennsylvania lines west of Pittsburgh the instructor in air-brake practice teaches not only the enginemen and firemen, but conductors and brakemen also.

The New York & New England Railroad has contracted for 50,000 tons of soft coal, at only $2.50 a ton, delivered in Boston. It paid $3 a year ago and $3.25 in 1893.

The long-pending claim of the Southern Pacific against the Government for $1,809,539 was included in the general deficiency appropriation bill last week by the Senate, but the House objected, and the clause was finally stricken out before the bill became a law.

The Brotherhood Committees which went to Washington to confer with Vice-President Baldwin of the Southern Railway, reached an agreement with him on Feb. 27, and the schedule of wages recently announced by the company and issued in pamphlet form, was signed by the committees.

The Atlantic Avenue Street Railroad Company, of Brooklyn, N. Y., has taken back 18 of its former employees, who struck, and at the time of doing so, President Benjamin Norton issued a notice announcing the fact, and stating that in case any new man was abused or intimidated by the restored strikers, five of the latter would be discharged, the names to be drawn by lot.

In a suit against the Cleveland, Cincinnati, Chicago & St. Louis for personal injuries in the Wann disaster, Jan. 21, 1893, a jury decided last week in favor of the road. There are several similar suits pending. It will be remembered that this was a collision, setting fire to some cars of oil; and that a large number of persons were burned by the explosion of oil some two or three hours after the collision took place.

A press despatch from Denver reports that the pay car of the Union Pacific was followed over the road on its last trip by a gang of swindlers who bought up employees' checks in large numbers, raised them to $110 each, and then passed them on storekeepers and others for small purchases, receiving considerable amounts of money in change. It is said that they worked in nearly every town where any considerable number of employees are located.

Messrs. Sanborn and Bailey, officers of the Old Colony Railroad are now out of prison, their sentences having expired. They were released at midnight on the night of March 1, a few days short of their four months' term, on account of good behavior, and the officers of the road, to the number of a dozen or more, went to Plymouth in a sleeping car and took them away within an hour after they were released. The event was celebrated by a breakfast in Boston, and employees brought bouquets to Mr. Sanborn's office.

The receivers of the Chesapeake, Ohio & Southwestern have reached an agreement with the employees on the wages question. Periodically since the 10 per cent. reduction was made, the employees have asked a restoration and each time a long explanation of the financial condition and earnings of the road was necessary. The receivers have decided upon a fluctuating scale. If in any month the gross earnings equal or exceed the gross earnings of the corresponding month of 1892, the wage scale of 1892 is to be paid; if not, the reduction will stand as now.—*St. Louis Republic.*

At the new terminal station of the Boston & Maine at Boston, the number of trains arriving and departing daily is so great that the capacity of the tracks is often taxed, although there are four main tracks at every point within a mile or two of the station. In order to secure the best possible efficiency of operation the train director in the pneumatic signal tower keeps a very minute record of all delays to trains, and it is reported that for two weeks recently the average delay of both outward and inward trains was only 21 seconds. Whether this includes trains which were on time or ahead of time is not stated.

A map of Ohio, showing the railroad lines on which through trains run into Cincinnati, appears in a recent issue of the Cincinnati *Times-Star*, in which it is shown that lines of this character touch important places in 75 different counties of the State. The aim was to show only such lines as have through cars, without change, into Cincinnati every day except Sunday; and the facts are set forth in such a way as to make the other cities of the State hide their heads in shame, or, at least, that seems to have been the intention of the maker of the map. The specific object is to show the readers of the *Times-Star* that Cincinnati is the most suitable city in the State in which to hold conventions.

The failure of the Patterson bill involves the postponement not only of pooling, but of several other necessary reforms, as the reader will remember. One of these, the clause amending section 10 of the Interstate Commerce Act, so as to abolish the imprisonment penalty and make corporations responsible for criminal acts of agents, was deemed so important that there was a move to have it passed in a separate bill. It was felt by the friends of the measure that this provision might, perhaps, encounter less opposition than was manifested toward the pooling provision. But the scheme failed; to pass the bill would have required a two-thirds vote, whereas the majority in favor of it was only 64 in a vote of 270.

Robbers.

A passenger train of the Houston & Texas Central was stopped by robbers near Dallas, Tex., on the night of Feb. 27. They made the engineer draw the express car forward a few miles, where they rifled it, but it is said that they did not get much money.

Near Tucson, Ariz., on Feb. 25, two train robbers compelled the engineer of a passenger train to cut off one car and run forward some three miles, but when they had got thus far they found that the car they had was not the express car, and they mounted their horses and rode off. Near Antelope, Cal., on the morning of March 3, two masked men held up the east bound overland express train, but after the express car had been cut off the engineer and fireman succeeded in scaring the robbers away.

George Morgan, one of the two men who robbed an express car on the Richmond, Fredericksburg & Potomac railroad a few months ago, has been tried and sentenced to 18 years imprisonment. His confederate seems to have got off, or at least to have thus far escaped punishment, by turning states evidence.

Floods in Pennsylvania.

High water, in connection with immense gorges of ice, caused considerable damage in the Susquehanna Valley last week, and blocked trains on the Philadelphia & Erie a day or two. At last accounts the water was falling, and it was believed that the ice would go out without doing great damage. Several bridges were carried away, however. At Safe Harbor, the bridge of the Columbia & Port Deposit Railroad was swept away, together with 10 loaded cars which had been placed upon it. A new bridge, owned by a street railroad company, was carried away at Buttonwood, Pa. On March 1, one span of the Baltimore & Ohio bridge at Layton, Pa., was carried away.

The New South Wales Railroads.

Mr. Eddy has at last consented to take another seven years' term as Chief Commissioner of Railways for New South Wales at a salary of £4,000 a year. Four months ago he declined to serve again, but, in spite of the extremely disagreeable political conditions, he has at last consented, which we have little doubt is a fortunate thing for the colony.

Electric Street Car Collision at Rankin, Pa.

A press despatch of Feb. 17 reports an accident at Rankin, Pa., which was somewhat peculiar, while at the same time typical of a class to which electric cars are more liable than horse cars. As a Second avenue car, bound toward Pittsburg, started to cross the Baltimore & Ohio tracks at 10 p. m. the trolley flew off leaving the car standing on the railroad tracks. As the conductors are required to run ahead of their cars at all railroad crossings to warn the motormen of approaching trains, there was nobody on the rear platform to put the trolley on the wire. Suddenly the headlight of the Eastern Express was seen, and the engineer was trying to make up lost time. The conductor of the street car saw it and yelled to the motorman to get the passengers out of the car and jump for his life; but one of the passengers was an Austrian girl, who did not understand the motorman, and kept her seat. The engine cut the car in two, and the girl was killed. Her head was cut off and her body badly mangled. Another passenger, who had jumped, was caught by one end of the car. His arms were crushed and he was injured internally.

Railroad Decisions by the United States Supreme Court.

The Supreme Court of the United States decided several railroad cases of importance on Monday, March 4. Justice White announced the opinion of the court that the assessment for taxes by the Territory of Arizona against the Maricopa Railroad was well grounded, and the judgment of the Supreme Court of the territory to that effect was affirmed.

The case of Cunningham versus the Macon & Brunswick Railroad of Georgia was decided against Cunningham. He represented certain bonds issued by the railroad in 1870 and endorsed by the state, which were subsequent to a similar issue of 1866. The road was seized by the state under the first issue, bought in by the state, and subsequently sold. The court below found that Cunningham had no claim, and dismissed his bill, and the Supreme Court of the United States affirmed that judgment.

A similar case was that of Johnson versus the Atlantic, Gulf & Western, appealed from Florida. The judgment of the court below, dismissing Johnson's bill, was affirmed.

Four cases appealed from the Supreme Court of Arkansas by the St. Louis & San Francisco involved the validity of the statute of that state regulating freight charges, the railroad company contending that it was in violation of certain privileges contained in its charter. The Supreme Court of Arkansas held that the statute was valid and the Supreme Court of the United States affirmed that judgment.

The Norfolk & Western appealed from the decision of the Court of Appeals of Virginia in two similar cases, affecting the act of that state regulating freight charges. The railroad company contended that the provision in the charter of its predecessor organization giving it power to make its own charges descended to itself. The court below took the view that the privilege did not so descend to the Norfolk & Western, and the Supreme Court of the United States affirmed its judgment.

The Defeated Pooling Bill.

The defeat of the pooling bill in the United States Senate has been the subject of discussion among the executive railroad officials at Chicago for the past two days. The Pooling Bill was not defeated by any one cause, but by a combination of unfortunate circumstances. Before the Sewell amendment was tacked on to the bill there was little or no opposition to it; in fact, it had been unanimously indorsed by the commercial interests throughout the United States, but this amendment, which practically made the power of the Interstate Commission nil, so far as its jurisdiction over traffic not pooled was concerned, caused the National Board of Trade to rescind its endorsement of the bill as amended.

This, combined with the protest of the press, gave the bill a blow from which it did not recover. After this amendment was withdrawn and the bill weathered through the House, it was met by a monopolistic opposition in the Senate, which carried more weight than the railroad lobby. This opposition was composed of the sugar trust, the Standard Oil Company, the dressed meat shippers and other formidable combinations of large shippers who have prospered under the rebate and cut-rate practices of the railroads, and who did not want a law which would have a tendency to stop all this and place the big shippers on a level with the small ones.

The defeat of the bill, however, will have a good effect on the railroads. For the past six months the executive officials of the lines running east and west out of Chicago have been very confident that the pooling bill would pass and would remedy existing evils, and so have made little effort to have rates maintained. The physical division arrangement of the roads west of Chicago has not been a success. . . . Now that this bill has been defeated there is a spirit among all the companies to make the best of physical divisions, maintain rates and stand out for revenue and not for business.—*Chicago Inter-Ocean.*

Seventy Passengers Killed in Mexico.

Press dispatches of March 1 report the derailment of an excursion train on the Interoceanic Railway, of Mexico, near Temamatla, in which 64 passengers, mostly women and children, were killed, and 50 or more injured. The train was conveying religious pilgrims back to the City of Mexico from Amecaneca, and, according to the reports, was derailed by running too fast on a curve, where the derailed cars fell some 30 ft. down a rocky embankment. This railroad is 3 ft. gage, and it would seem that the slaughter was largely due to the fragile character of the car bodies.

Mexico had already been the scene of the worst railroad accident ever known, the disaster of June 24, 1881, near Mailpois, on the Mexican Railway, ha ing resulted in the death of 214 soldiers. The number of persons killed in the case now reported has been exceeded in only seven other railroad accidents besides Mailpois, viz.: July, 1856, Camphill, 66 killed; June, 1864, Belœil, 83; December, 1876, Ashtabula, 80; December, 1879, Tay Bridge, 75; August, 1887, Chatsworth, 85; October, 1888, Mud Run, 66; June, 1889, Armagh, 78.

LOCOMOTIVE BUILDING.

The Richmond Locomotive Works has secured an order for engines from the Atlantic & North Carolina Railroad.

The Manchester Locomotive Works are now delivering locomotives ordered by the Bangor & Aroostook. These are 10-wheel freight locomotives and have the Westinghouse air-brake on both driving wheels and tender.

The Rogers Locomotive Works have completed for the Toledo, Peoria & Western the four consolidation locomotives ordered last December.

The Pennsylvania is building several switching locomotives of the Class "U" type, at its Altoona shops.

The Findlay, Ft. Wayne & Western will soon order one or two locomotives.

CAR BUILDING.

The Pittsburgh & Lake Erie Railroad has recently ordered 500 freight cars from the Michigan Peninsular Car Works, of Detroit. These cars are to be equipped with the Simons improved drop door and will have air brakes, Gould couplers and National Hollow brake beams.

The Chicago, Paducah & Memphis is reported in the market for 200 cars.

The Union Tank Line is preparing plans for tank cars to be over 40 ft. long. When the order is given out it will probably be for 90 cars. The cars will weigh 108,000 lbs.

BRIDGE BUILDING.

Atlanta, Mich.—Briley township, Montmorency County, will probably issue $5,000 in bonds, to build a bridge and a dam across the river at Atlanta.

Blue Earth County, Minn.—A bill to appropriate $1,000 to aid in the construction of a bridge in Blue Earth County across Blue Earth River, has been introduced in the Minnesota Legislature.

Brown County, Minn.—A bill is now before the Minnesota Legislature, authorizing an appropriation of $2,000 for a bridge across the Minnesota River, between Brown and Nicollet Counties.

Columbus, Tex.—The Commissioners' Court of Colorado County, Tex., will receive bids until March 18 for an approach span to what is known as the Cummins Creek bridge, and for one steel span 75 ft. long and 14 ft. clear roadway.

Congressional.—Among the bills passed by the last Congress and approved by the President are the following:

Authorizing the construction of a bridge over the Tennessee River, near Sheffield, Ala.; the Pittsburgh & Mansfield Railway Co. to construct a bridge across the Monongahela River; the Wisconsin & New Duluth Bridge Co. to construct a bridge across the St. Louis River, between Wisconsin and Minnesota; the Pittsburgh & Monongahela Railway Co. to construct a bridge over the Monongahela River, and a bridge across the the Illinois River, near Hennepin.

Cook County, Minn.—A bill has been introduced in the Minnesota Leoislature to appropriate $10,000 for the construction of roads and bridges in Cook County.

Craven County, N. C.—A bill has been introduced in the North Carolina Legislature to allow Craven County to build a bridge across the Neuse and the Trent Rivers.

Dawson County, Mont.—The President has signed the bill authorizing the construction of a bridge across the Yellowstone River, in Dawson County, Mont.

Denver, Col.—The Board of Public Works is to erect a new iron bridge at Cherry Creek. The Denver Tramway Company agrees to give $2,500 toward the construction of the bridge, the total cost of which will be about $10,000. Bids for building the bridge will be advertised at once.

Douglas County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $1,800 to build a bridge across the Long Prairie River, Douglas County.

Easton, Pa.—The Union Bridge Co., of New York, has just been awarded the contract for the erection of an important toll bridge across the Delaware River at Easton.

Ellicott City, Md.—William J. Widerman has been awarded the contract for building the bridge over Tiber Creek on Courthouse avenue.

Hennepin, Ill.—A bridge to cross the Illinois River from the Hennepin & Princeton road has been authorized by a bill which passed the Congress last week. The new bridge will carry railroad tracks and a roadway.

Homestead, Pa.—The bridge from Second avenue, Homestead, to the Salt Works station of the Baltimore & Ohio Railroad near Pittsburgh, built by the Homestead & Pittsburgh Bridge Company was opened last week. The bridge cost about $150,000 and was built by the Phœnix Bridge Company. Drake, Stratton & Co. were the contractors for the masonry work. It is 1,300 ft. long, with a center span of 370 ft. and two other river spans 232½ ft. each.

Jackson County, Minn.—A bill to appropriate $2,000 for a bridge across the Des Moines River in Jackson County has been introduced in the Minnesota Legislature.

Lake City, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $400 for the building of a steel bridge at Lake City.

Lexington, Mo.—A project for a bridge crossing the Missouri River at this point is attracting a good deal of local discussion, and it is claimed that more than $100,000 has been subscribed to the stock of the company to build the structure, the cost of which is estimated at $150,000.

McKeesport, Pa.—The bridge company which is to erect the new bridge over the Youghiogheny River has elected C. R. Stuckslager, President; J. C. Smith, Vice-President; H. H. Swaney, Secretary; and E. W. Pitts, Treasurer. The structure will span the Youghiogheny River at the foot of Fifth avenue and open a direct route to Reynoldstown, Dravosburg and Glassport. The bridge is to be of three spans and will cost about $100,000.

Minnesota River, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $2,000 to aid in constructing a wagon bridge across the Minnesota River.

Monongahela, Pa.—The bill authorizing the Pittsburgh, Monongahela & Wheeling Railroad, a recently organized corporation, to construct a bridge across the Monongahela River, near this town, has passed both houses of Congress. It was introduced in the House of Representatives by Congressman Dalzell as stated last week. The officers of the railroad company were given in last week's paper.

Norman County, Minn.—An appropriation of $1,500 for the construction of a bridge across the Wild Rice River, in Norman County, has been made by the State Legislature.

Olmstead County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $1,200 for building a bridge across the Zumbro River in Olmstead County.

Perth Amboy.—The New Jersey Legislature has passed the bill previously mentioned, authorizing Middlesex County, in which Perth Amboy is located, to issue its bonds to the amount of $150,000 to construct a drawbridge across the Raritan River at Perth Amboy.

Pittsburgh.—The United States Senate has passed a bill authorizing the erection of a new bridge over the Monongahela River at Pittsburgh at Ferry street with certain amendments suggested by the Pittsburgh Coal Exchange. The bridge is to have a span of 750 ft., and to be 80 ft. above the water.

Polk County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $3,000 to aid in building a bridge across Red Lake River in Polk County.

Redwood County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $2,500 to aid in building a bridge in Redwood County.

Rock County, Minn.—A bill to appropriate $500 to aid in the construction of a bridge across Rock River in Rock County has been introduced in the Minnesota Legislature.

Stevens County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $1,000 to aid in building a bridge in Stevens County.

Stewart Creek, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate $500 to aid in the construction of a wagon bridge across Stewart Creek, in Freeborn County.

Texas & Pacific.—Two important bridges on the line of this railroad in Texas are now under contract with the Youngstown Bridge Co., the work including tubular foundations 55 ft. in depth.

Toledo.—The Bridge Committee of the City Council has finally decided to build a swing bridge at Perry street. The Toledo Bridge Co. has the contract for $29,500. A provisional contract was made with the bridge company some weeks ago for a lift bridge at this point to cost $32,000.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Boston & Albany, $2 per share, payable March 30.
Chicago & Eastern Illinois, quarterly, 1½ per cent. on the preferred stock, payable April 1.
Delaware & Hudson Canal Co., quarterly, 1¾ per cent., payable March 15.
New York & Harlem, 3 per cent. on the preferred and common stock, payable from the earnings of the city line, April 1.

Stockholders Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Atlanta & Charlotte Air Line, New York City, March 13.
Canadian Pacific, annual, Montreal, Quebec, April 3.
Chicago & Alton, annual, Chicago, Ill., April 1.
Joliet & Chicago, annual, Chicago, Ill., April 1.
Malone & St. Lawrence, annual, New York City, March 19.
Missouri Pacific, annual, St. Louis, Mo., March 12.
Mohawk & Adirondack, annual, New York City, March 19.
New York & New England, annual, Boston, Mass., March 12.
Pennsylvania, annual, Philadelphia, Pa., March 12.
St. Louis, Iron Mountain & Southern, annual, St. Louis, Mo., March 12.
Texas & Pacific, annual, New York City, March 20.
Wabash, annual, St. Louis, Mo., March 12.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *Freight Claim Association* will hold its annual meeting in Chicago on March 13. The headquarters will be at the Auditorium. The Secretary is S. A. Mehorter, of Philadelphia.

The *Car Accountants' Association* will hold its next meeting at the Palace Hotel, San Francisco, Cal., on April 16, 17, 18 and 19.

The *Association of Railroad Air-Brake Men* will hold its next annual meeting in St. Louis, Mo., from April 9 to 11. The headquarters will be at the Lindell Hotel.

The *Master Car Builders' Association* will hold its annual convention at Thousand Islands, Alexandria Bay, N. Y., commencing June 11.

The *Master Mechanics' Association* will hold its convention at the same place, commencing June 17. Applications for rooms for both conventions should be made to J. B. Wistar and Charles W. Crossman, both at Thousand Islands, Alexandria Bay, N. Y.

The *Western Railway Club* meets in Chicago on the third Tuesday of each month, at 2 p. m.

The *New York Railroad Club* meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The *New England Railroad Club* meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October, at 10 a. m.

The *Southern and Southwestern Railway Club* meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The *Northwestern Railroad Club* meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The *Northwestern Track and Bridge Association* meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

The *American Society of Civil Engineers* meets at the House of the Society, 127 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The *Western Society of Engineers* meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 1736–1739 Monadnock Block, Chicago.

The *Engineers' Club of Philadelphia* meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The *Boston Society of Civil Engineers* meets at Wesleyan Hall, 36 Bromfield street, Boston, on the third Wednesday in each month, at 7.30 p. m.

The *Engineers' Club of St. Louis* meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The *Engineering Association of the South* meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The *Engineers' Society of Western Pennsylvania* meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7.30 p. m.

The *Technical Society of the Pacific Coast* meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The *Association of Engineers of Virginia* holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 710 Terry Building, Roanoke, at 8 p. m.

The *Denver Society of Civil Engineers* meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The *Montana Society of Civil Engineers* meets at Helena, Mont., on the third Saturday in each month, at 7.30 p. m.

The *Engineers' Club of Minneapolis* meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The *Canadian Society of Civil Engineers* meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The *Civil Engineers' Club of Cleveland* meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The Engineers' Club of Philadelphia.

The club met on Feb. 16, with 59 members and visitors present, and President Geo. S. Webster in the chair.

Mr. C. H. Ott described an ingenious solution of a problem in hydrostatics which had come under his notice at the town of Anniston, Ala., in 1882.

Mr. E. F. Miller exhibited and described a table showing maximum velocities and corresponding pressures in pounds per square foot of the wind in the neighborhood of Philadelphia, for each of the 12 months, from observations made by the United States Weather Bureau during the years 1873 to 1893. The pressures were much lower than was generally supposed, the highest value being about 13¾ lb. per square foot.

After some discussion the meeting adjourned.

American Society of Civil Engineers.

A regular meeting of the society was held on March 6. A paper on "A Line of 28-in. Cast Iron Submerged Pipe Across the Willamette River at Portland, Ore," by Franklin Riffle and A. S. Riffle, Members Am. Soc. C. E., was presented, of which the following is an abstract:

A CAST-IRON SUBMERGED PIPE ACROSS THE WILLAMETTE RIVER.

This line of 28-in. pipe, with flexible joints, crosses the river at a point 2,085 ft. wide at high water. It is part of a 6 mile 32-in. pipe line, connecting the Portland high service reservoirs on the two sides of the river.

The specifications called for vertically cast pipes, with an ultimate tensile strength of 18,000 lbs. per square inch, and tested to 250 lbs. pressure per square inch. There were 126 lengths of 17 ft. each. When laid the line was tested for 24 hours at a 200-lb. pressure, and it was not accepted until after 90 days of satisfactory service.

The trench, ranging in depth from 8 to 23 ft. and in bottom width from 10 to 12 ft., was dredged out by a bucket-dredge placed upon the side of a stern wheel steamboat. The dredge was kept in line by a row of piles driven along the line of the trench.

The work was done in the following manner: In the shallow water near each bank trestle bents were erected, one for each pipe, from which the pipes were suspended by long screws 1¼ in. in diameter, by means of which they were gradually lowered to position. In deep water a cradle in the form of an inverted bowstring was used. One end was supported and pivoted between two barges 10 ft. apart, while the other end was suspended between the barges at the rear, by a long rod always so attached that the cradle nearly touched the bottom of the trench.

The work averaged 80 lin. ft. a day. Much trouble was at first experienced from leakage of joints. Frequent tests were made as the work progressed, and it was observed that as the pressure increased the joints became tighter.

March 20, H. M. Wilson, M. Am. Soc. C. E., will address the society on the subject of "The Topographic Survey of the United States." April 3, a paper on "Specifications for Structural Steel" will be read by H. H. Campbell, M. Am. Soc. C. E.

The Publication Committee, in accordance with the resolution adopted Jan. 16, has assigned the evening of April 3 as a time for discussion of the report of the committee on "Uniform Methods of Testing Materials Used in Metallic Structures, and on Requirements for These Materials to Further Improve the Grade of such Structures."

Engineers' Club of St. Louis.

The club met on Feb. 20, with 21 members and 11 visitors present, and President Russell in the chair.

Mr. J. H. Curtis addressed the club on "A System of Water Purification," which he had developed, with special reference to the removal of organic matter.

Col. E. D. Meier then read a translation of a paper by Prof. August Ritter, of Germany, on "The Mechanics of Soaring Flights." The paper was intended to prove mathematically that where wind currents varied in velocity, it was possible for a bird to soar or rise without doing work itself. The paper claimed that repeated observations of soaring birds showed that there was no motion of the wings, and that very delicate observations of wind velocities indicate wide fluctuations.

During the discussion, Professor Johnson absolutely denied the premise upon which the paper is based. Professor Kinealy referred to Dr. Todd's paper written to prove that the soaring motion is due to a sculling movement of the bird's tail feathers. After some further discussion the meeting adjourned.

PERSONAL.

—Mr. W. H. Francisco has been appointed agent of the Atlantic & Pacific Fast Freight Line, with office in San Francisco, to succeed H. C. Bush.

—Mr. J. M. Lindley, Trainmaster for the Pennsylvania Company at Louisville, has been appointed Superintendent of Transportation for the Vandalia road, with headquarters at St Louis.

—Mr. W. D. Griswold, commercial agent of the Michigan Central in Chicago for many years, resigned March 1. He will be succeeded by J. H. Osborn, agent of the Michigan Central at Chicago Heights.

—Mr. W. W. Willock, of Allegheny, Pa., has been appointed General Manager of the Monongahela Connecting Railroad to succeed the late Mr. W. C. Quincy. The railroad is an important connecting freight line at Pittsburgh.

—Mr. E. R. Adams, Superintendent of the Philadelphia & Reading telegraph lines, died suddenly at Philadelphia, March 3. Mr. Adams was taken ill about four months ago with nervous prostration. He had been Superintendent of Telegraph since 1889.

—Mr. J. B. Denison, of the traffic department of the Atchison, Topeka & Santa Fe, at Chicago, has been elected Commissioner of the Galveston freight bureau, to succeed Mr. W. B. Groseclose, who resigned to accept the position of General Freight Agent of the Missouri, Kansas & Texas.

—Mr. Philip Kissam, who was recently elected President of the Findlay, Fort Wayne & Western Railroad in Ohio, died in New York City last week. Mr. Kissam was Manager of the real-estate properties of the Astor estate, and it was as representative of Mr. Astor that he was elected President of the company.

—Mr. A. P. Dupont, of Louisville, Ky., has been appointed General Manager of the Detroit Citizens' Street Railway Company, to fill the vacancy caused by the resignation of Mr. J. D. Hawks, who is now Vice-President and Manager of the Detroit & Makinac Railroad, formerly the Detroit, Bay City & Alpena.

—Mr. F. W. Mahl has been appointed Mechanical Engineer of the Southern Pacific, with headquarters at Sacramento, Cal., and is especially charged with the details appertaining to the establishment and maintenance of common standards for the motive power and rolling stock of the lines of the Southern Pacific.

—Mr. George W. Mudd, general foreman of the shops of the Eastern Division of the Wabash Railroad, at Wabash, Ind., has been appointed Master Mechanic of the Middle Division, including all the lines in Illinois. His headquarters will be at Springfield. Mr. Mudd was for some years with the Baltimore & Ohio, going to the Wabash in 1892. He will be succeeded on the Eastern Division by Mr. W. S. Cooper, of the Detroit-Chicago division, now at Montpelier, O.

—A number of important changes in the organization of the Carnegie Steel Company have been recently announced. Mr. Thos. Morrison, Superintendent of the Duquesne plant, has been transferred to the Edgar Thomson Works at Braddock, succeeding Mr. Gailey, who has been transferred to the general offices at Pittsburgh as assistant to President John G. A. Leishman. H. B. Miller, at present Master Mechanic of the Duquesne plant, becomes Superintendent.

—Mr. J. W. Morris has been appointed Division Freight and Passenger Agent of the Atlantic Coast Line with office at Charleston, S. C., his jurisdiction being over all railroads of that line south of Wilmington. Mr. Morris was Freight Agent at Charleston about a year, and he succeeded Mr. Rhett in that office, the latter becoming Treasurer of the Northwestern Railroad. Before his promotion to the Charleston agency he had been a soliciting agent for some years.

—Mr. W. H. Wallace, Assistant Division Superintendent of the New York, New Haven & Hartford Railroad, with headquarters at New Haven, has recently resigned that office. He has been in the service of the company for nearly 40 years. His successor as Assistant Division Superintendent is Mr. Peter E. Bowman, who has recently been in charge of the freight terminals of the company on the Harlem River at New York City, but was formerly Freight Agent at New Haven.

—Mr. L. A. Bell, General Passenger Agent of the Mobile & Birmingham road, has been appoined Division Passenger Agent of the Plant system at Montgomery, Ala. He will have charge of the line from Montgomery to Thomasville, Ga., 300 miles, and of the Plant line of steamers from Mobile to Tampa. Mr. Bell retains his connection with the Mobile & Birmingham road. He has also been Division Passenger Agent of the Southern Railway at Selma, Ala., but has resigned that position.

—Mr. F. H. Peters has been appointed Chief Engineer of the Galveston, La Porte & Houston Railroad in Texas; Mr. C. W. Nelson, Auditor, in addition to his previous duties as General Freight and Passenger Agent; and Mr. J. H. Taylor becomes Assistant Superintendent of the company. Mr. Taylor was formerly Superintendent of the North Galveston, Houston & Kansas City Railroad, which has been merged into the La Porte, Houston & Northern, forming the new company.

—Mr. S. R. Tuggle has been appointed Superintendent of Motive Power and Machinery of the Houston & Texas Central Railroad. This is an office created by this company last August. Mr. J. McGee, Master Car Builder of the railroad, was then appointed Acting Superintendent of Motive Power and Machinery, and held that office until March 1. Mr. Tuggle has been Superintendent of Motive Power of the Chesapeake & Ohio Southwestern, resigning that office to go to Texas.

—Mr. F. W. Chaffee, foreman of the West Albany Car shops of the New York Central & Hudson River Railroad has been appointed Master Car Builder for that division of the railroad to succeed Mr. L. Packard, deceased. George E. Kinner, foreman of the car-repair shop, succeeds Mr. Chaffee as head foreman, and a number of other promotions among the foremen of the shops have been made. Mr. Chaffee has been at the West Albany shops for the last 11 years, going there when Mr. Packard became Master Car Builder.

—Hon. William Ward, who died at Chester, Pa., on Feb. 27, was the promoter and president of a number of local railroads in Eastern Pennsylvania. He organized the Chester & Delaware River Railroad, an extension of the Philadelphia & Reading, and also the Chester Creek Railroad, of which he was Secretary and then President while it was operated as an independent line. It is now leased by the Pennsylvania. He was also for some time Solicitor for the Philadelphia, Wilmington & Baltimore Railroad, was a member of Congress in 1867, and held other political offices.

—Mr. George W. Thompson, President of the Ohio River Railroad, died at Washington, D. C., of pneumonia on Feb. 26. Mr. Thompson had been President of the Ohio River Railroad since 1886, and for three years before that date had been Vice-President and Treasurer, acting also as vice-president of the company which built the road. He was also President of two or three other short railroads in West Virginia connecting with the Ohio River line. He was a brother-in-law of Senator Camden, of West Virginia, President of the West Virginia, Central & Pittsburgh, and one brother, Colonel W. P. Thompson, is President of the National Lead Trust.

—The Bessemer gold medal of the British Iron & Steel Institute has been awarded to Mr. Henry M. Howe, of Boston, who is the fifth American to receive that honor. This is the third time that the medal has been awarded to an American within the last few years, Mr. Abram S. Hewitt receiving it in 1890, at the time of the visit of the English engineers to this country, and Mr. John Fritz being presented with the medal only last year. Mr. Howe is the author of the monumental work on the Metallurgy of Steel, and it is in recognition of his writings on the subject of steel making that the award of the medal is made to him.

—Mr. W. H. Taft, who has been Acting Superintendent of Motive Power of the Boston & Albany Railroad for the last two years, since the resignation of Mr. Underhill from that office, has been appointed Purchasing Agent of the company. This is a new office, and Mr. Taft will retain his headquarters in Boston where they have been since his appointment as Superintendent of Motive Power. Before Mr. Underhill's resignation he had been Division Master Mechanic at Boston. His appointment as Purchasing Agent results in a number of changes in the Mechanical Department. Mr. T. B. Purves, Jr., who has been Division Master Mechanic at Boston, is transferred to Springfield as Superintendent of Motive Power. Mr. C. H. Barnes, who has been Division Master Mechanic at Springfield, is transferred to Boston in the same capacity. Mr. Barnes is a son of the General Manager of the company. No Division Master Mechanic will be appointed at Springfield, the Superintendent of Motive Power taking the duties of the office.

—Mr. Charles McFadden, a widely known railroad contractor, died at Philadelphia last week. His work as a contractor was chiefly confined to Eastern States, Pennsylvania in particular, and few if any contractors who confined their operations to these States, built so many miles of railroad. In early life he was engaged on the Pittsburg Division of the Pensylvania Railroad, then on the construction of the Pittsburg & Connellsville road, now the B. & O.'s Pittsburgh Division. He built the Huntingdon & Broad Top and the East Brandywine & Waynesburg roads, and in 1861 he went to the Schuylkill coal regions, and built several small roads, which are now important parts of the Philadelphia & Reading road. Other work done by him was on the Lehigh Valley exten-

sion, from Mauch Chunk to Wilkes Barre; the Perkiomen road, the Lebanon & Tremont, now a Reading branch; the Columbia and Port Deposit and the Alexandria & Fredericksburg, in Virginia. A large portion of what is known as the Pennsylvania Low Grade Division was constructed by Mr. McFadden, including the Summit Tunnel, and other heavy work. He also built a portion of the Easton & Amboy road, including the Musconnetong Tunnel, the Erie branches, from Bradford to Du Bois, sections of Pennsylvania's Schuylkill Valley Division; a portion of the South Penn road, including the Allegheny Mountain Tunnel, and about 30 miles of the Poughkeepsie bridge system.

ELECTIONS AND APPOINTMENTS.

Chicago, Milwaukee & St. Paul.—J. H. Foster, formerly Superintendent of the James River Division, has been appointed Superintendent of the Wisconsin Valley Division, with headquarters at Babcock, Wis., to succeed R. R. Minturn, transferred.

Chicago, Rock Island & Pacific.—Mr. W. T. Rankin has been appointed Assistant General Attorney of the lines in Illinois and Iowa. Mr. Rankin has been Assistant General Solicitor for the Pullman Palace Car Co. for several years. His headquarters will be at Chicago.

Dallas Belt Line.—The company has been organized at Dallas, Tex., by the election of the following officers: President, George Howard Ellers, Chicago; Vice-President, Frank M. Cockrell, Dallas; Secretary, Walter A. Calhoun, St. Louis; Treasurer, James C. Holden, New York City. Board of Directors, George H. Ellers, Chicago; James C. Holden, New York; Walter A. Calhoun, St. Louis; F. M. Cockrell, H. J. Martyn, Tom Scurry and C. C. Cobb, Dallas, Tex.

Fort Worth & Denver City.—E. W. Hayes, formerly Master Mechanic at Fort Worth, Tex., has been appointed Superintendent of Motive Power.

Houston & Texas Central.—S. R. Tuggle has been appointed Superintendent of Motive Power and Machinery of the railroad, with office at Houston, Tex.

Illinois Central.—The office of George H. Stearns, General Eastern Agent of the Illinois Central, has been removed from 343 Broadway to 387 Broadway.

Mexican Interoceanic.—R. Preston, Master Mechanic of the Puebla shops, has been transferred to the Vera Cruz shops in charge of the locomotive and car departments.

New York Central & Hudson River.—Charles F. Smith, for many years Secretary to General Manager Toucey, has been promoted to be Chief Clerk in the office of the Superintendent of the Western Division, in Buffalo.

F. W. Chaffee has been appointed Master Car Builder of West Albany Car Shops, with headquarters at West Albany, vice Mr. L. Packard, deceased.

New York & New England.—Alfred Richard, General Foreman of the East Hartford shops, has resigned and has been succeeded by Mr. Murray, General Foreman of the Norwood shops of the company near Boston.

Northern Central.—The stockholders held their annual meeting at Baltimore on Feb. 28. The stockholders re-elected the Board of Directors by a vote of 106,431 shares. Mr. G. B. Roberts was elected President; Frank Thomson, John P. Green and Charles E. Pugh, Vice-Presidents; A. W. Hendricks, Treasurer, and Stephen W. White, Secretary.

Northern Pacific.—Mr. James McNaught, formerly general counsel to the Northern Pacific Company, and subsequently associate counsel to the receivers, will hereafter, have his offices at St. Paul. Mr. Wm. Nelson Cromwell, of New York, has been appointed general counsel to the receivers. The associate counsel, Mr. Miller and Senator Spooner, will continue in their present positions.

Pennsylvania.—R. E. McCarty has been appointed Assistant Trainmaster, with headquarters at Pittsburg, vice H. F. Bickell, resigned. In addition to the duties assigned him as Trainmaster, he will have charge of the passenger crews and equipment of the Pittsburgh Division.

Pullman's Palace Car Co.—Superintendent D. H. Martyn, of the company at St. Louis, announces the following changes: J. C. Morrison, District Superintendent, Union Station, St. Louis, transferred to New Orleans, vice J. B. Tristram, resigned; T. B. Boothby, appointed District Superintendent, Union Station, St. Louis, vice J. C. Morrison, transferred; and J. F. Baker appointed Assistant District Superintendent, St. Louis.

San Antonio & Brownsville.—The following officers have been elected, the company having just been incorporated in Texas: J. S. Doak, President; and J. M. Puette, Vice-President and General Manager, San Antonio, Tex.; E. Mullen, Secretary and Treasurer, Yoakum, Tex.; and J. A. Hinman, Chief Engineer, San Antonio. The directors are J. S. Doak, San Antonio: J. S. Whitsell, Campbellton, Tex.; J. W. Preston, Pleasanton, Tex.; Lee Doak, Fort Worth, Tex.; and J. M. Wallace, J. A. Ball and W. O. Hogan, all of San Antonio, Tex.

Southern Pacific.—W. K. McAllister has been appointed Acting General Agent for this company, with headquarters at Denver, Col., vice W. E. Halm, General Agent, resigned.

Texas Central.—The following is a corrected list of the directors and officers elected at the annual meeting on Feb. 13.: Directors, Henry K. McHarg, Stamford, Conn., Amadee D. Moran, New York City, Walton Ferguson, Stamford, Conn., Edward Rotan, R. B. Parrott, Jesse S. McLendon, and Charles Hamilton, Waco, Tex. Officers, President, Henry K. McHarg; Vice-President and General Manager, Charles Hamilton; Secretary and Treasurer, Richard Oliver, Waco: Assistant Secretary and Assistant Treasurer, D. Comyn Moran, New York; Auditor, Richard Oliver, Waco, and General Attorney, L. W. Campbell, Waco.

RAILROAD CONSTRUCTION,
Incorporations, Surveys, Etc.

Alabama Roads.—Bills to incorporate the Coosa Iron & Railroad Company and the Chicago, Florence & Gulf Railway have passed the Alabama Legislature.

Batavia & Northern.—The New York State Railroad Commissioners have this week decided in favor of the company the petitions of the Batavia & Northern and the International & Oak Orchard Railroad for authority from the Commissioners to construct those roads, which are to practically form one line from Batavia, N. Y., north to Oak Orchard Harbor on Lake Ontario. The road will extend from Batavia, north through Albion to Oak Orchard Harbor on Lake Ontario, crossing the West Shore road, the Niagara Falls branch of the New York Central, and the Rome, Watertown & Ogdensburg. The route lies through a rich agricultural country. The cars will be ferried over to Port Hope, on the Canadian side, by car floats, of which three or four will be built. It is expected that the road will have a heavy traffic in coal from Western Pennsylvania. Near Hastings, Canada, there is a large extent of iron ore, which will give a return freight for cars that go over loaded with coal. There will also be a considerable traffic in barley from Canada. At Oak Orchard Harbor a large hotel will be built and it is expected that this place will become a great summer resort. The construction work will be light. Citizens from Orleans and Genesee Counties, through which the road will pass, were present and urged the granting of a charter. The promoters say that there will be no trouble about securing a charter. The officers of the company are: Robert Avery, 45 Broadway, New York City, President; William H. Hazzard, 361 Fulton Street, Brooklyn, Vice-Prrsident; Richard Schemerhorn, Chief Engineer; George Wingate, Secretary, and George A. Wingate, Counsel. The general offices for the present will be at 168 Montague Street, Brooklyn, N. Y.

Chesapeake, Shenandoah & Western.—This project has been taken up by E. C. Machen, of New York City, who has built the Macon & Northern and other short railroads in the Southern States. The charter for the company was secured at the last meeting of the Virginia Legislature, M. Erskine Miller, of Staunton, Va., H. N. Bell and others being incorporators. The route described in the charter is a general one, a line from the Potomac River across the State to West Virginia.

Galveston, La Porte & Houston.—The former consolidation of the La Porte, Houston & Northern and the North Galveston, Houston & Kansas City railroads in Texas under the above name was effected on Feb. 18 last, and the officers of the consolidated company are now operating the property. James Waldo, formerly Vice-President of the Missouri, Kansas & Texas, is President of the new company, and T. W. Ford, C. H. Hammett and Isaac Heffron are Vice-Presidents, all of Houston, Tex. The construction work to complete the through line between Galveston and Houston is now progressing favorably. The track on the line into La Porte, Tex., has been completed and the grading and bridge work necessary to complete the other gaps in the line is being pushed as rapidly as possible. The line from Harrisburg into Houston from the terminus of the Houston Belt & Magnolia Park Railroad, which is also included in the consolidation, will be completed by May 1. Altogether about 16 miles of railroad will be constructed to complete the through line, and then there will be three railroads operating between Galveston and Houston. The company has authority to bridge Galveston Bay between Virginia Point and Galveston, the bill having been signed by the President within a few days. The capital stock has been increased to $600,000 to carry out the improvements mentioned.

Langenburg & Southern.—Application has been made at Ottawa, Can., for this company to construct a line from Langenburg, in the district of Assiniboia, to join the Canadian Pacific between Red Jacket and Elkhorn, Manitoba, and also a branch to Binscarth, Manitoba.

Nova Scotia South Shore.—Claims amounting to nearly $40,000 have been filed against this company at Yarmouth, N. S., the construction headquarters, and other claims have been filed against Monroe, Strang & Co., of New York, the contractors for the railroad. This company was organized about a year ago, and in October last began the construction of a standard gage railroad along the southern coast of Nova Scotia from Yarmouth to Shelburne, the distance being about 70 miles. The President of the company is R. G. Hervey, of New York City. Monroe, Strang & Co., a southern firm, undertook the construction work, and brought an extensive grading outfit from Baltimore to Nova Scotia last fall. This line was one of two projects for a railroad along the southern coast of Nova Scatia. The opposing line had secured a subsidy from the Provincial Government, and was able to secure local interest in its enterprise. The South Shore project had secured a subsidy from the Dominion Government for about 300 miles of its line and the promise of a subsidary for the entire railroad if it should be completed. The local feeling was against the project and in favor of the narrow gage line, which has done considerable work. The South Shore officers had to purchase right of way, and were put to considerable extra expense in other ways on account.

Pennsylvania.—The work of changing the tracks of the Pennsylvania Railroad through New Brunswick, N. J., has been blocked for the present by legal proceedings which will involve the city. A property owner has secured an order restraining the city and the Pennsylvania Railroad from proceeding with the proposed change on Somerset street. The Common Council recently adopted an ordinance sanctioning the straightening of the tracks of the Pennsylvania Railroad through this city under certain conditions. Mr. Barr objects to the change on Somerset street, claiming that it will damage his property.

Rio Grande Northern.—Several parties of engineers are still working on the surveys for this railroad, which is to reach coal fields in the western part of Presidio County, Tex., near the Rio Grande River. The line will be about 27 miles long, starting from the station called Chipas on the Southern Pacific, extending south to the San Carlos coal mines. This coal is claimed to be of an excellent quality, burning to a white ash, and can be mined and sold for $2.50 a ton. The Southern Pacific is to use it on its lines. The only important work in the construction on the railroad will be on the Third Division, where there are a number of heavy cuts and one short tunnel. The road goes through an unsettled country to the coal mines. The contract for the railroad has been let to G. Kiel, of San Antonio. The Chief Engineer is G. L. Marshall, and James M. Hamilton is Division Engineer.

Santa Fe, Prescott & Phoenix.—On March 11, the completion of the Santa Fe, Prescott & Phoenix Railroad from Ash Fork, N. Mex., on the line of the Atlantic & Pacific, to Phoenix, Ariz., will be celebrated. The occasion is of considerable importance, as the building of this line to the north gives good railroad facilities to a most valuable mining district and a fertile and already well-developed valley access to better markets.

In the spring of 1889, the attention of the late Joseph Reynolds, of Chicago, was directed to the feasibility and probable profit to be derived from the construction of a railroad across central Arizona from the north to the south, so as to include the mining district where he was operating, and the progressive irrigation enterprises of the valleys tributary to the great rivers that flow into the Colorado. Mr. Reynolds, familiarly known as "Diamond Jo," was at the time interested in the Congress mine, which earned for his estate after his death something over a million dollars, and this new proposition appealed to his daring character. He visited Salt River Valley, looked over the improvements made and contemplated, and was soon most enthusiastic over the railroad proposition.

The county of Maricopa went into the scheme with almost unanimous vote, and the proposition to issue county bonds for the railroad was readily enough carried. This vote was approved by Congress, but the bill was vetoed by President Harrison. Personal subscriptions to the amount of $300,000 were made, but they never became available. The legislature passed a bill exempting railroads constructed under certain conditions and restrictions, from taxation for 20 years. "Diamond Joe," died soon after this legislative assistance was secured, but the enterprise was taken up by others and carried forward, though through many difficulties and against many obstacles. Among the capitalists and influential men who aided the enterprise were N. K. Fairbanks, of Chicago; D. M. Ferry, of Detroit; the Reynolds estate; Charles Arms, of Youngstown, Ohio, and others interested in irrigation and mining enterprises in the territory. Surveys and construction went on slowly as the financial negotiations progressed. Only 18 miles were completed in 1892, in the following year, 42 miles, in 1894, 93 miles and the final section of 47 miles into Phoenix has been rapidly constructed, the last rail having been put down on Feb. 27.

The route passes through considerable desert land, a large portion of which is now under possible irrigation by means of great canals. It breaks through some mountainous districts, which necessitated heavy construction work and where a grade of 3 per cent. is maintained for a considerable distance. The company is well equipped for freight and passenger business, having 8 locomotives, 6 passenger coaches, 4 combination coaches, 25 standard box and 50 platform cars. The rails are 57 lb. and 65 lb. sections. The line is standard gauge. F. M. Murphy is President; G. W. Vaughn, Vice-President and General Manager; R. R. Coleman, Superintendent; F. A. Healy, General Freight and Passenger Agent.

By this new railroad the prosperous Salt River Valley with its 20 irrigating canal companies and productive farms is brought into easy communication with the rich mining districts to the North, which heretofore have been practically inaccessible, and a route to the east is secured with all that that implies. The forests with their timber are now made tributary to the valleys of the South, and New Mexico coal can find a new market in a district that has depended solely upon wood for fuel. The Arizona people make much of the fact that their irrigated districts escaped the frosts which injured the Florida orange orchards this winter, while they claim for their climate and soil with the abundance of water, advantages that place their land favorably before the investor and settler. The fact, also, that their season is six weeks ahead of that of California is also mentioned to their further advantage.

Texas & Pacific.—The company has recently resumed the work of laying 75 lb. rails on that portion of its main line between Dallas and Fort Worth. The work of relaying the road between these points with the heavier section will probably be completed within a month. The new rails replace 56 lb. and 63 lb. sections. The company will probably also make considerable progress this year in taking out the iron rails on the western portions of its line and replacing them with steel rails. About 185 miles of the Rio Grande division are still laid with iron rails.

GENERAL RAILROAD NEWS.

Atchison, Topeka & Santa Fe.—The report of earnings for the seven months to Jan. 31 issued this week, gives the following comparisons with the previous year:

	1895.	1894.	Dec.
Gross earn.....	$24,115,303	$26,814,188	D. $2,698,885
Operating earn.....	17,447,954	18,192,197	D. 644,243
Net. earn.....	$6,667,349	$8,721,991	D. $2,001,642

These figures include the earnings of the Atlantic & Pacific and the Colorado Midland. The Atlantic & Pacific and the Colorado Midland show increased gross earnings as compared with 1894, though the net earnings are slightly decreased on account of the augmented operating expenses. The net earnings of the entire system are $6.667,349, a decrease of over $2,000,000 from those of 1894.

Green Bay, Winona & St. Paul.—First mortgage bondholders of this railroad have applied to the United States Circuit Court at Milwaukee for a receiver pending the sale of the road at foreclosure. The application was made by William S. Mowry, of New York, and it is supposed that the purpose is to obstruct the reorganization by the recently formed committee which called upon bondholders to deposit their securities. Mr. Mowry represents a number of old first mortgage bondholders who did not assent to the reorganization of 1892, and since the property was not sold under foreclosure at that time these old bonds are still a valid claim against the property.

Houston, East & West Texas.—President E. S. Jemison, of this company, has prepared a bill and submitted it to the State Legislature, giving authority to the company to lease the Houston & Shreveport Railroad. This road is the Western Division of the Houston, East & West Texas, and it is about 40 miles long, extending from Shreveport, La., to Logansport, and was built in 1885. The two companies are now operated as one line from Houston to Shreveport, La., 232 miles.

Norfolk & Western.—The directors issued a statement on Feb. 27, giving some account of the conditions that brought about the recent appointment of receivers. The statement first gives the following exhibit of earnings for the year 1894, which are made public for the first time:

The gross earnings were $10,340,452, an increase as compared with the previous year of $307,835; operating expenses and taxes were $7,693,905, an increase of $494,445, leaving the net earnings $2,646,547, a decrease of $186,610. The total income was $2,782,132. The interest on funded debt, car trusts and on the floating debt amounted to $3,026,865. With the rentals on leased lines and the deficit in operating expenses on those lines the total charges were $3,255,224. The sinking fund equipment mortgage of 1888 called for $145,300, making the total disbursements for the year $3,400,524, the gross earnings as being above $2,782,132. The deficit for the year, after the payment of all fixed charges, losses on leased lines and sinking funds is thus shown to have been $618,392, in addition to which the company had to meet maturing payments on car trusts and other capital accounts, and to this end had to borrow additional sums of money, thus adding to its previous floating indebtedness so that on Jan. 31, 1895, the floating debt of the railroad company, including that of the Roanoke Machine Works, the

entire stock and bonds of which corporation are owned by the railroad company, amounted to $1,008,448, represented by bills payable, secured by collateral belonging to the company. The unpaid vouchers, taxes, pay rolls and other current liabilities, exclusive of January accounts, amounted to $653,462. The statement also shows that in 1893 the deficiency amounted to $277,333.

"The growth of the company's traffic and earnings has been continuous since its organization in 1881, when, with a mileage of 428 miles, its tonnage was 538,102 tons, and its gross earnings $2,267,289. During 1894 the company operated 1567 miles, its freight traffic amounted to 7,039,817 tons, and its gross earnings $10,340,452; but during the past two years the company operated 439 miles of new lines through sections of country in which mining and other industrial enterprises had to be inaugurated and encouraged, and traffic developed, while full interest charges on the cost of construction of the new lines had to be paid, and, as for the most part these lines were through mountainous country, requiring numerous bridges and tunnels, their construction was necessarily expensive, and the interest charges correspondingly heavy."

The business depression retarded the development of the new lines and lessened the income to the company from them. The net earnings on the older portions of the railroad also fell off seriously on account of the lower freight rates, in spite of a considerable increase in traffic and gross earnings. Two-thirds of the company's traffic is in coal and coke, carried at very low rates. The statement is made that payments for car trusts during the next eight years for rolling stock purchased before 1893 to provide for the traffic on the new lines will call for nearly $3,500,000. The necessity for the appointment of receivers is stated in the following paragraph: "The interest charges, rentals, car trust payments, and sinking funds, payable during the year 1895, aggregate about $1,000,000 more than the net earnings of 1894, and by reason of the inability of the company to earn its fixed charges during the two preceding years, and by the business conditions generally prevailing and the loss of confidence in the company's ability to meet its obligations, the company's credit was so impaired and the market prices of its securities so much affected, that the management of the company were unable to make the necessary financial provision."

On Jan. 29 President Kimball wrote to John C. Brown, a banker of New York City, and other large stockholders, including J. Kennedy Tod, George Coppell, of New York City, and foreign representatives, informing them of the position of the company. That committee recommends a reduction in the interest rate on the recent issues of the company's bonds and assessments of the preferred and common stocks to provide sufficient funds to pay all the car trusts and floating debt. The committee believes that the reorganization can be effected in a short time, and the company placed in a position to develop its business and earn returns for the security holders.

Northern Pacific.—A recent decision in the Circuit Court of the United States has given the representatives of the third mortgage bonds, who are opposed to the so-called general or Adams re-organization committee, of which E. D. Adams is Chairman, a representation in the foreclosure proceedings and a committee representing those bondholders, E. R. Dicks, E. B. Van Nostrand of New York City and others ask the support of the third mortgage bondholders to oppose the proposed the re-organization plan of the Adams committee. The Adams committee announces that it has secured deposits of nearly $21,000,000 of the consolidated mortgage bonds under its agreement; $1,000,000 more than a majority of the third mortgage bonds, the committee lacking about $3,000,000 of a majority of the second mortgage bonds. The committee urges that the most favorable re-organization of the property can be secured by the united action of these three classes of bondholders rather than by separate committees.

The Adams Reorganization Committee of the Rail road Company has taken up the remainder of the issue of Receivers' certificates. The committee originally took $2,500,000 and agreed to take the other half of the issue as the Receivers might require the funds to conserve the trust estate. They have since taken up $2,400,000, making the total amount now outstanding $4,900,000.

Philadelphia & Reading.—In the United States Circuit Court, at Philadelphia, on March 2, the Pennsylvania Company for Insurances on Lives and Granting Annuities, as trustee for the mortgage bondholders, filed a bill in equity praying for the foreclosure of the general mortgage of that road. This action has been expected for some time, the trustees having been requested two months ago to institute proceedings for the foreclosure of the general mortgage. The institution of foreclosure proceedings is the fulfillment of a pledge made by the Olcott-Earle Reorganization Committee, which represents the holders of more than $30,000,000 of general mortgage bonds, which were deposited under their abandoned plan of reorganization.

The following table shows the earnings for January and the two months to Jan. 31:

Month of January:	1895.	1894.	Inc. or Dec.
Gross receipts	$1,568,3 7	$1,394,295	I. $174,012
Operating expenses	942,020	889.447	I. 52,573
Profit in operating	$626,287	$504,848	I. $121,439
Net receipts from o her sources	89,013	88,073	I. 940
Profit for month	$715,300	$592,921	I. $122,379
Equ pment payments	106,930	102,698	I. 4,232
Terminal trackage	50,000	50,000	.....
Improvements and renewals	20,247	23,581	D. 2,234
One-twelfth of year's fixed charges (est.)	705 000	704,470	I. 530
Total charges	$882,177	$880,750	I. $1,427
Deficit	$166,876	$287,829	D. $120,953
Two months to Jan. 31:			
Gross receipts	$3,120,235	$3,146,807	D. $26,571
Operating expenses	1,889,087	1,861,732	I. 27,355
Profit in operating	$1,231,148	$1,285,075	D. $53,926
Net receipts from other sources	161,956	117,861	I. 14,094
	$1,393,104	$1,432,936	D. $39,831
Profit for month	199,740	229,359	D. 29,619
Equipment payments	100,000	100,000	.....
Terminal trackage, improvements and renewals	61,717	50,767	I. 10,940
Fixed charges, estimated	1,410,000	1,408,940	I. 1,059
Total charges	$1,771,458	$1,789,067	D. $17,608
Deficit	$378,354	$356 131	I. $22,223

The gross receipts of the Coal & Iron Company were $1,892,957 for the month, a decrease of $308,575 from 1894, and for the two months the earnings were $3,863,692, a decrease of $382,480. The deficit for January, 1895, was $193,372, and $133,787 in January, 1894. The deficit for the last two months amounts to $486,800.

Rio Grande Southern.—Judge Allen, of the State Court at Denver, has granted the petition of Edward T. Jeffrey, Receiver of the Rio Grande Southern Railroad, to sign a contract with the Denver & Rio Grande Railroad, by which the indebtedness of the Rio Grande Southern is extended three years and the management is assumed by the Denver & Rio Grande Road.

Savannah, Americus & Montgomery.—The foreclosure sale of this railroad in the suit brought by the Bondholders' Committee has been postponed to May 17 on the order of the Georgia State Court at Americus, Ga. The securities of the company are largely held in Baltimore, and the financial management of the property is directed in that city. The postponement of the sale was secured by the Bondholders' Committee in order to give time to complete certain arrangements for the rehabilitation of the property which had come up in the past month and made it undesirable to have the property sold at the present time. T. Edward Hambleton, of Baltimore, and S. H. Hawkins, of Americus, Ga., formerly President of the railroad, are the present receivers.

Southern.—The Southern Railway Company took possession on March 1 of the Asheville & Spartanburg and Spartanburg, Union & Columbia Railroads in North Carolina, under a new agreement with John H. Inman and his associates, who owned a controlling interest in the two roads. Under the new permanent arrangement the owners of the properties will receive a rental of $40,000 a year, instead of $80,000 as heretofore, and 5,000 shares of preferred and 5,000 shares of the common stock of the Southern Railway Company.

Texas Trunk.—The United States Circuit Court at Dallas, Tex., last week issued a decree of foreclosure in the suit brought by the Central Trust Co., of New York, trustee. The road was ordered sold at Dallas in June next. The amount of indebtedness of the company is something over $308,000. The road is about 47 miles long, extending from Dallas southeasterly to the small townof Kemp and has been operated by a receiver for a long time.

Valley (Ohio).—A committee, of which Louis Fitzgerald, President of the Mercantile Trust Co., of New York, is chairman, has within a week issued a plan for the reorganization of this property endorsed by the officers of the Baltimore & Ohio Railroad. The following statement gives the bonded and other indebtedness of the Valley road: First mortgage 7 per cent. bonds, interest from Dec. 15, 1891, $1,600,000; consolidated mortgage 6s in hands of public, $1,524,000; common stock, $1,240,800; advances by Baltimore & Ohio, $822,000; receivers' certificates, $1,025,526.

In addition to the above, expenditures of $449,000 for terminals are required, and more will have to be expended for equipment and betterments. It is proposed to foreclose under such of the mortgages as the comittee may direct. The following new securities are to be issued: 100-year gold 1st 4s, $5,500,000, secured by first mortgage, guaranteed by the B. & O. Preferred stock, $2,200,000, six per cent. non-cumulative, and common stock, $5,200,000.

The securities are to be distributed as follows: For each present first mortgage bond with overdue coupons, $1,213, 11 new first 4s. For each present consol with overdue coupons, $500 new first 4s and $750 new preferred stock. For each $50 share of present common stock, $50 new common stock, after payment of $5 per share assessment (10 per cent). The other debts of the Valley Company are to be treated with as follows: For $822,000 owned by the Valley to the B. & O. there will be given $411,000 new 4s and $411,000 new preferred stock. For interest on this debt, $120,000 new 4s will be given. For receivers' certificates $1,025,526 new 4s will be reserved, and for expenses and cash reserve $791,498 of the same bonds. The cash received from assessment will be similarly applied. The Baltimore & Ohio is to be given $540,000 preferred stock, in part consideration of its guarantee of the new bonds, and $106,000 preferred will be applied to cash requirements. The amount of new common stock to be issued to the general public is $605,700 (upon payment of $5 assessment). The B. & O. will receive $4,594,300 of the common stock upon surrender of the common stock which it owns and in part consideration of its promised guarantee of the 4 per cent. bonds. The new terminal property to be acquired in Cleveland will cost $449,000, and new 4 per cent. bonds at par are reserved for this purpose.

Western New York.—This company was incorporated in New York State on Feb. 28 with a capital of $10,000,000. The incorporation is part of the proceedings for the reorganization of the Western New York & Pennsylvania Railroad Company, whose property was sold at public auction on Feb. 5 last under the foreclosure of a mortgage held by the Fidelity Insurance Trust & Safe Deposit Co. The directors are: Isaac N. Seligman, Gustav E. Kissel, David J. Seligman, Howard Mansfield, Henry A. James, Albert Symington, Emil Carlebach, Albert Strauss, Charles D. Lithgow, Edward D. Phillips, Charles C. Howard, Patrick F. Vaughn and John E. Derby, of New York city. The new company is to be consolidated with a company incorporated in Pennsylvania, under the old title.

TRAFFIC.

Traffic Notes.

The competition between rival street car lines at Savannah, Ga., which has been severe for many months, has now been carried so far that on one line two tickets are sold for one cent. One of the companies, in the hands of a receiver, has been ordered by the court to advance fares from one cent to five cents, and the rival companies have been ordered to come into court and show why they also should not advance their rates.

The New York, New Haven & Hartford has settled, at 50 per cent. of their face value, a number of claims for loss of freight in a large fire at New Haven in July, 1893. The fire occurred during a heavy thunder storm and when suits were brought by owners of freight the company set up as a defense that the fire was caused by the act of God.

In the United States Circuit Court at St. Louis, Feb. 28, Judge Sanborn made an order directing the receivers of the Union Pacific to continue the present traffic arrangement between the Union Pacific and the Oregon Short Line. There has been objection by the American Loan and Trust Company of Boston, but the order was finally made without opposition.

It is stated in a Boston paper that the railroads centering in that city now refuse to carry stereopticon lecturers' gas tanks in baggage cars. The showmen are indignant, of course. They claim that the action of the road is based on the false ground that a dentist's gas tank exploded in a baggage car, and that dentists'tanks carry a very much higher pressure than theirs.

The Colorado Fuel and Iron Company has sent a petition to the Inter-State Commerce Commission praying that the roads from Chicago to the Pacific coast be compelled to cease discrimination in freight rates against Denver, Pueblo, and other Colorado points.

The leading Ocean steamship companies have sent a formal notice to the Trunk-Line Association requesting that body to cease sending immigrant business by the Grand Trunk, because, as alleged, it persists in discriminating against the port of New York by granting high commissions on immigrant business via Montreal.

Chairman Caldwell, of the Western Trunk Line Passenger Committee, has issued a ruling that the Southern California (Atchison) was acting contrary to the provisions of the agreement in reducing the eastbound rate from $52.50 to $50 to meet the alleged competition of an outside line (the Texas & Pacific). The chairman rules that the matter should have first been presented to the Committee to determine whether the competition was "outside competition" and warranted the granting of authority to meet it. It is probable that the Atchison will give notice of a restoration of the rate and present the whole question to the Committee for determination.

A conference of interested lines was held at Omaha last week to try and bring about a readjustment of rates on coal, but no agreement was arrived at. The Union Pacific insists that its recent reduction of 50 cents a ton from Rock Springs, Kan., to points in Kansas and Nebraska was necessary, but the Atchison and Rock Island will not admit the claim.

The Seaboard Air Line, in consequence of the unfriendly action of the Southern Railway and Steamship Association, has issued a circular stating that "the principal competitors of the Seaboard Air Line, having announced that they could not secure all of the business except through the questionable method of a boycott, and having declared one, the Seaboard Air Line announces the following passenger rates:

First-class, good for 30 days, between Atlanta and New York, via Portsmouth, reduced from $24 to $14; Philadelphia, $21.50 to $11.30; Baltimore, $17.50 to $9.50; Portsmouth and Norfolk, $14.75 to $8; Petersburg, $15.50 to $9.15; Richmond, $15.50 to $9.80. Passengers are reminded that the Atlanta special vestibuled limited runs solid, making quicker time between Atlanta and Washington, three hours quicker time to New York than any train upon which no extra charge is made.

It is reported from Philadelphia that the Philadelphia & Reading has notified the Lehigh Valley and the Central of New Jersey that if they do not consent to give the Reading a larger share of the through freight rates on coal the Reading will refuse to haul coal originating at points on either of the other lines to points south of Bethlehem and East Penn Junction except at local rates.

Chicago Traffic Matters.

CHICAGO, March 6, 1895.

Work is progressing slowly on the details of the agreement of the new Western Trunk Line Passenger Committee. The Missouri, Kansas & Texas and the Missouri Pacific having agreed to become members of the association, conditioned on the establishment of a southwestern committee which will be formed, the only road in the southwest remaining out is the Wabash, and that line will come in if some satisfactory arrangement can be reached between it and the Alton regarding the application of Kansas City-St. Louis rates to East St. Louis. The Alton insists upon the rate and the Wabash opposes it. No satisfactory method has been found of pacifying the Grand Trunk and the Trunk Lines regarding the differential rate allowed the Canadian Pacific. The eastern lines want the differential question re-opened, but the western lines propose to keep the cork in the bottle which they found so much trouble in fitting with any kind of a stopper, realizing that to re-open the question would be to undo all that has been accomplished.

There is no improvement in eastbound rates, and none is now looked for, for some time. In fact, even conservative railroad managers are becoming apprehensive that a general demoralization of rates is about to ensue. Among the western lines, where rates have been better maintained than with the eastern lines for the past six months, there is a growing uneasiness, and it would not take much provocation to precipitate a general scramble. There are several weak spots, and the situation is regarded critical enough to warrant the calling together of the presidents to consider measures necessary for the maintenance of present rates. The pass agreement continues operative, although it is severely strained in some portions of the territory. There are several lines that would be glad to pull out from it if they did not fear the consequences of being the first to break away. Nevertheless, it is doing considerable good, and is without doubt saving a great deal of revenue to the roads.

By the action of the Chicago-Great Western, party and theatrical rates of two cents a mile have been put in all territory between Chicago and the Missouri River, following the adoption of the rate between Chicago and St. Paul some time ago.

Lumber dealers in Northern Minnesota and Wisconsin have petitioned the roads from that territory to reduce lumber rates in order to enable them to compete with the Southern pine shippers.

On March 1, the Chicago City ticket office of the Chicago, Milwaukee & St. Paul, was moved to the new Marquette Building on the corner of Adams and Dearborn streets. This is the first of a large number of ticket offices which will move to this building.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending March 2 amounted to 58,768 tons, against 58,316 tons during the preceding week, an increase of 452 tons, and against 67,940 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	Week to March 2.		Week to Feb. 22.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central	4.778	8.1	6,.99	10.5
Wabash	5,156	8.8	5.214	8.8
Lake Shore & Mich. South.	6,191	10.5	4,363	8.0
Pitts.,Ft. Wayne & Chicago	10,805	8.4	9,4 3	16.2
Pitts.,Cin.,Chi. & St. Louis.	5,067	8.6	10,410	18 0
Baltimore & Ohio	3.011	5.1	3.9 1	6.7
Chicago & Grand Trunk	5.779	9.8	5.882	10.1
New York, Chic. & St.Louis	7,220	12.3	4 8 8	8.9
Chicago & Erie	9 073	15.5	6.789	11.7
C., C., C. & St. Louis	1,695	2.9	1,087	1 8
Totals	58,768	100.0	58,316	100.0

Of the above shipments 5,878 tons were flour, 23,866 tons grain and mill stuff, 11,526 tons cured meats, 8,141 tons dressed beef, 1,400 tons butter, 1,299 tons hides and 5,197 tons lumber.